

TECHNOLOGY DEPARTMENT

R

# THE JOURNAL OF THE INSTITUTION OF PRODUCTION ENGINEERS

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## Principal Contents :

### THE BUILDING OF ROLLING MILLS

by M. A. FIENNES, M.I.P.E.

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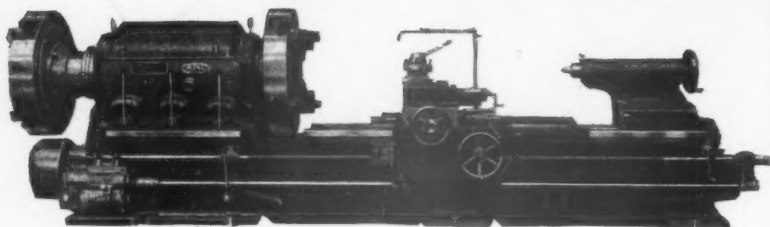
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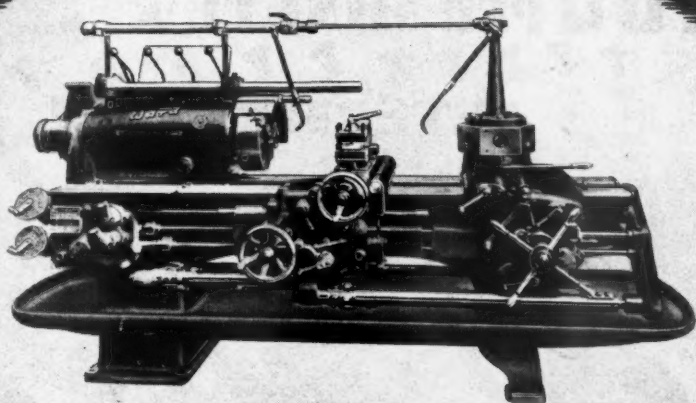
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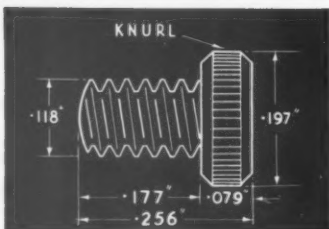


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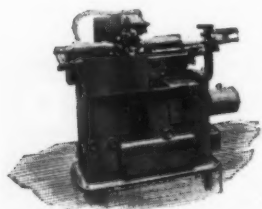


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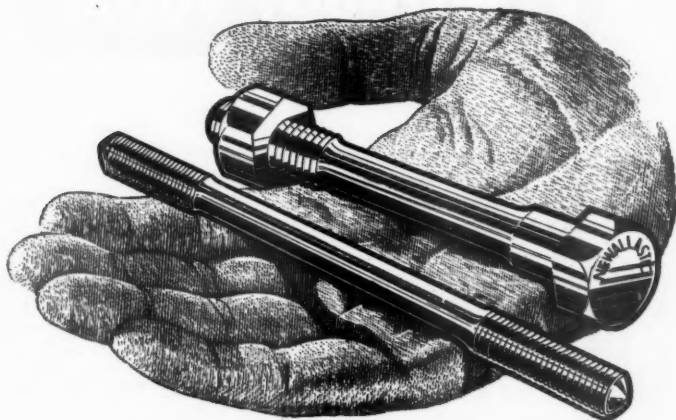


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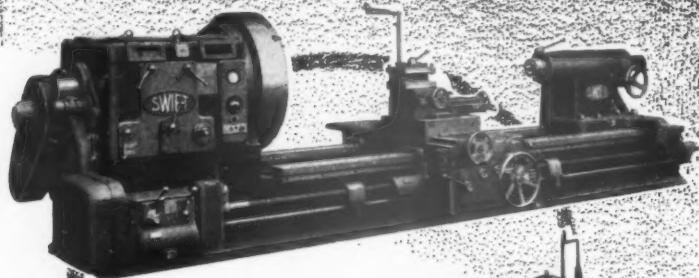
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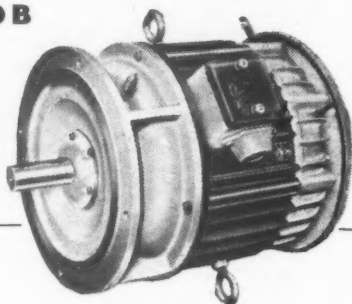
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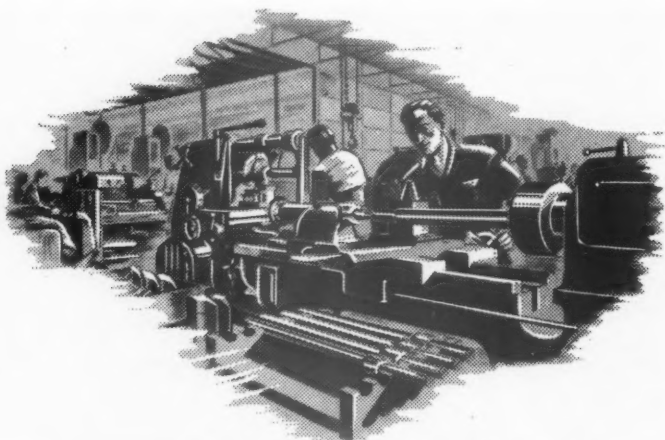
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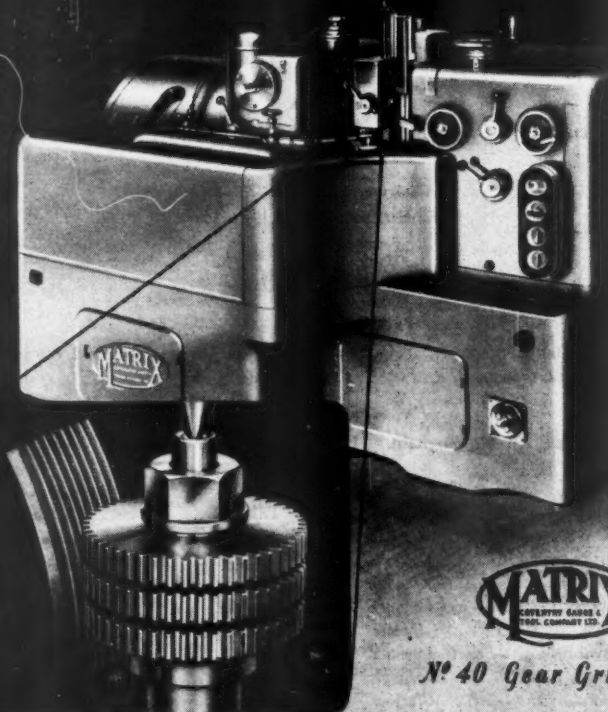
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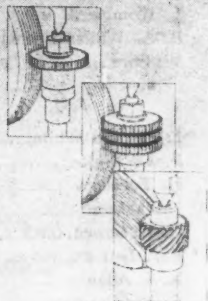
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**H. NUTTON, M.I.P.E.**

Institution Personalities — 15.



H. NUTTON, M.I.P.E.

### **Mr. H. NUTTON, M.I.P.E.**

Mr. H. Nutton, President of the Halifax Section of the Institution and Member of Council, is Works Manager of J. Sagar & Company Limited, manufacturers of woodworking machinery. He was elected a full Member of the Institution in 1941, and has served on the Committee of the Halifax Section since its formation in 1944.

Mr. Nutton began his apprenticeship with his present firm in 1911. After training in the Machine Shops and Fitting Department he was for a number of years in the Testing Department, and for some time Chief Outside Erector.

In 1926 he was appointed Technical Representative for Lancashire, Cheshire, North Wales and later Westmoreland and Cumberland. In 1933 he returned to the Works where for two and a half years he was in charge of Testing before receiving his present appointment. Since then Mr. Nutton has been responsible for carrying out widespread re-organisation of the Halifax Works and other associated Works of the Company concerning works layout and extension, planning and production control, quality control, rate fixing, etc. He has also been responsible for the complete re-fitting of the Halifax Works with the most modern machine tools and equipment.

During the war years, Mr. Nutton played a leading part in connection with the development of specialised equipment produced by the firm, particularly of a complete range of airscrew production machinery, and has since supervised widespread sub-contract manufacturing programmes necessitated by the need for urgent expansion in the firm's products.

A great believer in technical training up to the Higher National Certificate standard for all engineering apprentices, Mr. Nutton himself received his technical training at evening classes at the Halifax Technical College, where he received certificates which were forerunners of the National and Higher National Certificates. For three consecutive years he was awarded the Halifax Engineering Employers Federation Medal for the most successful student. He also spent two years on the evening Technical Staff of the Halifax Technical College.

## INSTITUTION NOTES

*February, 1950*

### NEW YEAR HONOURS

The Institution offers sincere congratulations to the following members whose names appeared in the New Year Honours List :

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Mr. J. W. Howlett, O.B.E., Managing Director of Wellworthy Piston Rings, Ltd.

Mr. G. A. Aldred, M.B.E., Chief Engineer, British Ropes, Ltd.

Mr. J. B. Stevenson, M.B.E., Works Director of E.M.I. Factories Ltd.

### WORK MEASUREMENT RESEARCH

New developments of great importance to production engineering practice have been made possible through the establishment of a Work Measurement Research Unit within the Department of Engineering Production at the University of Birmingham.

The members of this Research Unit are :—

Professor T. U. Matthew, Ph.D., M.Sc., M.I.P.E.

Mr. P. B. R. Gibson, M.A., A.M.I.Mech.E.  
(Lecturer in Engineering Production).

Mr. D. J. Desmond, M.Sc., M.I.E.E.  
(Tube Investments Research Fellow).

Mr. C. J. Anson, B.A.  
(D.S.I.R. Research Scholar).

Mr. Desmond and Mr. Anson are engaged in the field work and industrial visits necessary for the development of the project.

### MAIN OBJECTIVES

The main objectives of the Unit, which is conducting full-time research work on this subject, are as follows :—

- (a) To investigate, with the co-operation of industrial firms and production engineers, the existing standards of consistency and accuracy obtaining in time study rating practice between individual engineers, firms, and industries, and to determine

the allowances required as compensation for fatigue and other factors in different occupations and under different working conditions.

- (b) To establish methods of work measurement which will enable the work content of industrial operations to be determined on a more precise basis than hitherto. These methods which will incorporate the use of reference data, will enable individuals firstly to be trained to a standard level of consistency and accuracy in Work Measurement, and secondly, to maintain this standard by continual reference to this data.
- (c) To define on an acceptable reference basis, a "Standard Work Unit," which can be applied to measure and compare the output and productivity of individuals, firms, and industries. This will constitute a reliable basis for international comparison of industrial productivity.

In addition, the Research Unit is co-operating with the Joint Committee on the Measurement of Productivity of the Institution of Production Engineers and the Institute of Cost and Works Accountants, together with other bodies, so that when the second stage of the project is reached, a wide and representative range of industrial firms can be invited to participate in the development and use of reference standards through these channels. The research work will thus be placed on a national basis.

Finally, this Research Unit is working in close co-operation with the American Society for the Advancement of Management, with the objective of using the same standard reference data. Ultimately as a further result of this work, it should be possible to establish and maintain international comparisons of labour effort and productivity on a sound basis.

**ANGLO-AMERICAN PRODUCTIVITY TEAMS** Mr. J. R. Bergne-Coupland, Works Manager of Ruston & Hornsby Limited, Iron Works, and Vice-Chairman of the Lincoln Sub-Section, recently returned from the U.S.A., where he was leading the Anglo-American Productivity Team on Oil Engine Manufacture.

Mr. A. Nicholl, Methods Engineer, Ruston & Hornsby Limited, Boutham Works, and Mr. H. Smith, Head Erecting Foreman, also of Ruston & Hornsby's, were members of an Anglo-American Productivity Team which left the United Kingdom for the U.S.A., on 4th January, to study the manufacture of Diesel Locomotives.

**MEETING IN READING**

A Lecture Meeting has been arranged for Tuesday, 21st February, 1950, to take place at the Great Western Hotel, Reading, at 7.15 p.m. On this occasion Mr. B. H. Dyson, M.I.P.E., F.I.I.A., will give an address on "Production Management's Responsibility for Productivity".

This is the first Institution meeting to be held in Reading, and it is hoped that all members in the vicinity will make every effort to attend and make the occasion a successful one. Visitors will, of course, be welcome.

**NEWS FROM AUSTRALIA** On retiring from office in October last, Mr. E. L. Offen, President of the Sydney, N.S.W. Section, gave an address in which were a number of points of interest to members generally. In outlining the growth of the Institution in Australia over a period of ten years, he gave the membership in all grades as 168 in Sydney Section, and 197 in Melbourne—a worthy total of 365. He also devoted a considerable part of his address to the question of Technical Education in Australia, and the part the Institution had been able to play. It was pleasing to note the high regard in which Mr. C. A. Gladman is held, and the good work he has done since going to Australia from Britain in 1947, to take up the duties of Lecturer in Charge of Production Engineering at Sydney Technical College. All members will congratulate Australia on an excellent first ten years.

### NEWS OF MEMBERS

Mr. J. C. McBride, Associate Member, has taken up an appointment as Senior Methods Engineer with Hoover Limited, Perivale, Greenford, Middlesex.

Mr. J. R. Moore, Associate Member, has been appointed Production Manager of the Fisher Section of Elliot Bros. (London) Ltd., at Rochester.

Mr. I. K. Dewar, Associate Member, has taken up an appointment as Assembly Workshop Manager of the British Olivetti Co. Ltd., of Glasgow.

Mr. James Gray, Associate Member, has been transferred from the R.O.F. Patricroft to the Ministry of Supply, Strand, W.C.2, and now holds the position of Technical Assistant I in the Directorate of Guns and Carriages.

Mr. J. V. Steele, Associate Member, has been appointed to the Board of Directors of G. & D. Donaldson Ltd., Liverpool.

Mr. R. M. Wright, Associate Member, has been appointed Assistant Works Manager in the Pakistan Ordnance Factories.

Mr. R. F. Turner, Associate Member, has joined the Board of the Pioneer Laundry Limited, Liverpool, as Engineering Director.

Mr. R. Marsh, Associate Member, has taken up an appointment as Works Manager of Fisher Clark Engineers Limited of Boston, Lincs.

**VISITOR FROM  
ABROAD**

Mr. James M. Steer, Honorary Secretary of the Sydney Section, is visiting the United Kingdom, and will pay a visit to the Institution Headquarters.

Mr. Steer was very largely responsible for the establishment of the Institution in Australia, and as Honorary Secretary of the Sydney Section since its formation thirteen years ago, has done a great deal to further the interest of Production Engineering in the Dominion.

**OBITUARY**

The Institution announces with deep regret the death of Mr. A. E. Newby, M.B.E., a former member. Mr. Newby had been a past President of the Eastern Counties Section, and was for many years a member of their Committee. At the time of his death Mr. Newby was President of the Ipswich Engineering Society. The Institution was represented at the funeral by Mr. H. H. Dawson, President of the Eastern Counties Section.

The Institution has also learned with deep regret of the deaths of Mr. J. P. D. Coleman, Director of Wild-Barfield Electric Furnaces Limited, of Watford, an affiliated firm, and the following Members :

Mr. L. M. Ellis of Birmingham Section.

Mr. A. Elword of London Section.

Mr. H. Nock of Sheffield Section.

Mr. C. Godden of London Section.

Mr. G. J. Jennings of London Section.

**BRITISH STANDARD** The following Standard has recently been issued and is obtainable from the British Standards Institution, 24/28, Victoria Street, S.W.1, price 2/- (post free).

1591 : 1949, Acid-resisting high silicon iron castings.

The I.P.E. is represented on the appropriate B.S.I. Committee by Mr. F. Blackith, M.I.P.E.

**BOOKS RECEIVED**

"The Non-Ferrous Metal Industry in Germany during the period 1939-1945". B.I.O.S. Surveys Report No. 23. H.M.S.O. Price 3/6 net.

**ISSUE OF JOURNAL TO NEW MEMBERS** Owing to the fact that output has to be adjusted to meet requirements, and in order to avoid carrying heavy stocks, it has been decided that the Journal will only be issued to new Members from the date they join the Institution.

**IMPORTANT**

In order that the Journal may be despatched on time, it is essential that copy should reach the Head Office of the Institution not later than 40 days prior to the date of issue, which is the first of each month.

**SECTION MEETINGS**

The following meetings have been arranged to take place in February and March, 1950. Where full details are not given, these have not been received at the time of going to press.

**February**

- 1st NOTTINGHAM SECTION. A lecture on "Joint Consultation," to be illustrated by a sound film, will be given by Mr. F. E. Maer, M.I.P.E., at the Victoria Station Hotel, Milton Street, Nottingham, at 7-00 p.m.
- 1st PRESTON SECTION. A lecture on "Corrosion of Metals" will be given by Mr. W. Murray, A.M.C.I., F.R.I.C., F.C.S., M.Inst.F., at Clayton, Goodfellow & Co. Ltd., Atlas Iron Works, Park Road, Blackburn, at 7-15 p.m.
- 1st WOLVERHAMPTON SECTION. A lecture on "Drop Forgings, Production Practice and Application" will be given by Mr. R. P. Brookes, at the Dudley and Staffordshire Technical College, Dudley, at 7-00 p.m.
- 3rd BIRMINGHAM SECTION. A lecture on "Productivity and Costs" will be given by Mr. W. S. Risk, B.Comm. (Edin.), C.A., F.C.W.A., at the Chamber of Commerce, 95, New Street, Birmingham, at 6-30 p.m. This will be a Joint Meeting with the Birmingham Branch of the Institute of Cost and Works Accountants.
- 3rd WEST WALES SUB-SECTION. A lecture on "The Metallurgist's Place in Production Engineering" will be given by Mr. E. R. Gadd, F.I.M., at the Y.M.C.A., St. Helen's Road, Swansea, at 7-30 p.m.
- 3rd EASTERN COUNTIES SECTION. A lecture on "Motion Study" will be given by Miss Anne G. Shaw, M.A., M.I.P.E., in the Lecture Hall, Electric House, Ipswich, at 7-30 p.m.
- 4th YORKSHIRE GRADUATE SECTION. A visit has been arranged to the Hunslet Engine Co. Ltd., Jack Lane, Leeds 10, commencing at 2-15 p.m.

**February---cont.**

- 6th HALIFAX SECTION. A lecture on "The History and Development of the Automatic Loom" will be given by Mr. H. de G. Gaudin, B.A., M.I.Mech.E., at the White Swan Hotel, Halifax, at 7-15 p.m.
- 6th YORKSHIRE SECTION. A lecture on "Industrial Finishes" will be given by Messrs. C. F. Hennessey, and C. C. Gladwell, at the Hotel Metropole, King Street, Leeds, 1, at 7-00 p.m. This will be followed by a film entitled "The Technique of Spray Painting."
- 8th MANCHESTER GRADUATE SECTION. A lecture on "Surface Coating and Synthetic Finishes" will be given by Mr. W. Howard, A.M.I.Mech.E., in the Reynolds Hall, College of Technology, Manchester, at 7-15 p.m.
- 9th CORNWALL SECTION. A lecture on "Diesel Engine Development" will be given by Mr. Freeman Sanders, M.I.A.E., at Holman's Canteen, Dolcoath Road, Camborne, at 7-15 p.m.
- 9th SOUTHERN SECTION. A lecture on "History and Development of the Diesel Engine" will be given by Mr. J. Whitaker at the University College, Southampton, at 7.15 p.m.
- 10th COVENTRY SECTION. A lecture on "Modern Developments in Measurement Including Screw Threads" will be given by Mr. W. H. Foster, A.M.I.P.E., M.I.E.I., at the Greyfriars Rooms, The Geisha Cafe, Hertford Street, Coventry, at 7-00 p.m.
- 10th WESTERN SECTION. A lecture on "Electronics in Industry" will be given by Mr. L. G. Ward, B.Sc., at the Wheatstone Hall, Brunswick Road, Gloucester, at 7-30 p.m.
- 11th BIRMINGHAM SECTION. The Senior and Graduate Sections will hold a Buffet Dance at the Botanical Gardens, Edgbaston.
- 13th SHEFFIELD SECTION. A lecture on "Ball and Roller Bearing Manufacture" will be given by Mr. R. K. Allan, A.M.I.Mech.E., M.I.P.E., at the Royal Victoria Station Hotel, Sheffield, at 6-30 p.m.

**February—cont.**

- 14th BIRMINGHAM GRADUATE SECTION. A "Brains Trust" has been arranged, when questions will be answered by leading Industrialists, at the James Watt Memorial Institute, Great Charles Street, Birmingham, 3, at 7-00 p.m.
- 14th DUNDEE SECTION. A lecture on "Air Operated Fixtures" will be given by Mr. C. M. P. Willcox, at Mathers Hotel, Whitehall Crescent, Dundee, at 7-15 p.m.
- 15th BIRMINGHAM SECTION. A lecture on "Automatic Bar Machines and their Application from the User's Point of View" will be given by Mr. A. W. Nye, at the James Watt Memorial Institute, Great Charles Street, Birmingham, 3, at 7-00 p.m.
- 15th EDINBURGH SECTION. A lecture on "Air Operated Fixtures" will be given by Mr. N. P. Watts, at the North British Station Hotel, Edinburgh, at 7-30 p.m.
- 15th LIVERPOOL SECTION. A lecture on "Costing as an Aid to Management" will be given by Mr. H. H. Norcross, A.I.P.E., F.C.W.A., F.I.I.A., at Radiant House, Bold Street, Liverpool, at 7-15 p.m. This is a joint meeting with the Institute of Cost and Works Accountants, the Institute of Industrial Administration and the Institute of Office Management.
- 15th LONDON GRADUATE SECTION. A visit has been arranged to the Glacier Metal Company Ltd., Alperton, Wembley, Middlesex, commencing at 2-30 p.m.
- 15th LUTON GRADUATE SECTION. A lecture on "Photography in Industry" will be given by Mr. G. A. Jones, M.A., A.R.I.C., F.R.I.S., in the Small Assembly Room, Town Hall, Luton, at 7-30 p.m.
- 15th WESTERN SECTION. A lecture on "Activities of the Production Engineering Research Association" will be given by Dr. D. F. Galloway, B.Sc.(Hons.), M.I.P.E., at the Grand Hotel, Bristol, at 7-15 p.m.
- 16th GLASGOW SECTION. A lecture on "Precision Casting" will be given by Dr. F. H. Hudson, F.I.M., at the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, C.2, at 7-30 p.m.

**February—cont.**

- 16th LONDON SECTION. A lecture on "Works Organisation for Large Scale Research and Development of Aircraft Engines" will be given by Mr. J. S. Paget, B.A.(Cantab.), A.M.I.Mech.E., M.I.P.E., at the Royal Empire Society, Northumberland Avenue, London, W.C.2, at 7-00 p.m.
- 16th WOLVERHAMPTON GRADUATE SECTION. A lecture on "Resistance Welding" will be given by Mr. C. E. Slade, M.Inst.W., at the Dudley and Staffordshire Technical College, Dudley, at 7-00 p.m.
- 17th LONDON GRADUATE SECTION. A lecture on "Valid Incentives" will be given by Mr. E. C. Gordon England, F.R.Ae.S., M.I.P.E., F.I.I.A., at the Institution of Production Engineers, 36, Portman Square, London, W.1, at 7-15 p.m.
- 17th NORTH EASTERN GRADUATE SECTION. A film show has been arranged, when "Through the Mill," "The Tube Age" and "Pluto Job 99" will be shown in the Neville Hall Mining Institution, Westgate Road, Newcastle-upon-Tyne, 1, at 7-00 p.m.
- 18th YORKSHIRE GRADUATE SECTION. A lecture on "Photo-Elasticity for Engineers" will be given by Mr. J. Ward, B.Sc., Ph.D.(London), M.I.Mech.E., M.I.Mar.E., at the Great Northern Station Hotel, Leeds, 1, at 2-30 p.m. This lecture will be illustrated by lantern slides and a display of models and photographs.
- 20th DERBY SUB-SECTION. A lecture on "Arc Welding" will be given at the School of Art, Green Lane, Derby, at 7-00 p.m.
- 20th NORTH EASTERN SECTION. A lecture on "The Human Factor in Productivity" will be given by Dr. Elliot Jacques, M.D., in the Neville Hall Mining Institution, Westgate Road, Newcastle-upon-Tyne, 1, at 7-00 p.m.
- 21st READING. A lecture on "Production Management's Responsibility for Productivity" will be given by Mr. B. H. Dyson, M.I.P.E., F.I.I.A., at the Great Western Hotel, Reading, at 7-15 p.m.
- 22nd NORTHERN IRELAND SECTION. A lecture on "The Education of the Production Engineer" will be given by Mr. T. B. Worth, M.I.Mech.E., A.M.I.E.E., M.I.P.E., at the Municipal College of Technology, Belfast, at 7-00 p.m.

**February—cont.**

- 22nd SHREWSBURY SUB-SECTION. A lecture on "Modern Milling Practice" will be given by Mr. W. S. B. Kidd, at the Technical College, Shrewsbury, at 7-30 p.m.
- 22nd SOUTH WALES AND MONMOUTHSHIRE SECTION. A lecture on "Precision Castings for General Engineering Purposes" will be given by Dr. F. Hudson, F.I.M., at the South Wales Institute of Engineers, Park Place, Cardiff, at 6-45 p.m.
- 23rd LEICESTER AND DISTRICT SECTION. Three Papers will be read by Section Members, followed by a discussion at the Leicester College of Technology, Room 104, The Newarke, Leicester, at 7-00 p.m.
- 23rd LUTON GRADUATE SECTION. A visit has been arranged to the Wealdstone Works, Kodak Ltd., Harrow, Middlesex. Further information may be obtained from the Section Honorary Secretary.
- 23rd BIRMINGHAM GRADUATE SECTION. An afternoon visit has been arranged to Hams Hall "B" Power Station, Lea Marston, Minworth, Birmingham.
- 25th HALIFAX GRADUATE SECTION. A lecture on "Noise and Vibration in Machinery" will be given by Dr. W. A. Tuplin, D.Sc., M.I.Mech.E., at the White Swan Hotel, Halifax. The Annual General Meeting will be held at 2-00 p.m., and will be followed by the above lecture at 2-30 p.m.
- 27th MANCHESTER SECTION. A lecture on "Advance of Industrial Heat Treatment" will be given by Mr. J. McHenry, A.M.I.F., A.M.I.T., at the College of Technology, Sackville Street, Manchester, at 7-15 p.m.
- 28th LINCOLN SUB-SECTION. An evening visit has been arranged to the works of Rose Bros. (Gainsborough) Ltd., Gainsborough, commencing at 7-00 p.m.
- 28th LUTON, BEDFORD AND DISTRICT SECTION. A documentary film on "Mechanical Handling" will be shown in the Small Assembly Room, Town Hall, Luton, at 7-00 p.m.

**March**

- 1st COVENTRY GRADUATE SECTION. A lecture on "Gear Cutting Procedure" will be given by Mr. H. Pearson, B.A.(Oxon.), in Room A.5, Coventry Technical College, The Butts, Coventry, at 7-15 p.m.

**March—cont.**

- 1st NOTTINGHAM SECTION. The Annual General Meeting, which will be followed by sound films of general engineering interest, will be held at the Victoria Station Hotel, Milton Street, Nottingham, at 7-00 p.m.
- 1st PRESTON SECTION. A lecture on "Modern Foundry Practice" will be given by Mr. C. S. Johnson, at the Harris Institute, Corporation Street, Preston, at 7-15 p.m.
- 1st WOLVERHAMPTON SECTION. A lecture on "Manufacture and Application of Gears" will be given by Mr. J. P. G. Rhind, B.Sc., A.M.I.Mech.E., at the West Midland Gas Board Demonstration Room, Clarence Street, Wolverhampton, at 7-00 p.m.
- 2nd GLASGOW SECTION. An Informal Discussion on "Foremanship" will be presented by Mr. H. Gardner at the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, C.2, at 8-00 p.m.
- 4th YORKSHIRE GRADUATE SECTION. A visit has been arranged to the British N.S.F. Co. Ltd., Ingrow Bridge Works, Keighley, the manufacturers of Radio and Electrical Components, commencing at 2-30 p.m.
- 6th HALIFAX SECTION. A lecture on "Costing as an Aid to Management" will be given by Mr. H. H. Norcross, A.I.P.E., F.C.W.A., F.I.I.A., at Whiteley's Cafe, Westgate, Huddersfield, at 7-15 p.m.
- 6th YORKSHIRE SECTION. The Annual General Meeting will be held at the Hotel Metropole, King Street, Leeds, 1, at 7-00 p.m.
- 7th WOLVERHAMPTON GRADUATE SECTION. A lecture on "Machine Tool Trends" will be given by Mr. C. Eatough, B.Sc., M.I.Mech.E., at the West Midland Gas Board, Demonstration Room, Wolverhampton, at 7-15 p.m.
- 8th NORTHERN IRELAND SECTION. A lecture on "Colour Schemes for Factories and Machines" will be given by Mrs. D. M. Buckland, at the Municipal College of Technology, Belfast, at 7-00 p.m.
- 9th CORNWALL SECTION. A Production Engineers' Quiz has been arranged to take place at Holman's Canteen, Dolcoath Road, Camborne, at 7-15 p.m.

**March—cont.**

- 9th LONDON GRADUATE SECTION. A lecture on "The Graduate's Opportunity in Industry" will be given by Mr. B. H. Dyson, M.I.P.E., F.I.I.A., at the Institution of Production Engineers, 36, Portman Square, London, W.1, at 7-15 p.m.
- 10th COVENTRY SECTION. A Dinner and Dance has been arranged to take place at the Masonic Hall, Coventry.
- 10th WEST WALES SUB-SECTION. A lecture on "The Effective Use of Metals" will be given by Dr. E. G. West, Ph.D., B.Sc., in the Civic Buildings, Swansea, at 7-30 p.m.
- 13th SHEFFIELD SECTION. A lecture on "Development in Design and Manufacture of Heavy Steel Works Plant" will be given by Mr. W. Bailey, at the Royal Victoria Station Hotel, Sheffield, at 6-30 p.m.
- 14th BIRMINGHAM GRADUATE SECTION. A lecture on "Production Methods for Medium Sized Presswork" will be given by Mr. J. L. Williams, A.M.I.Mech.E., M.I.W., at the James Watt Memorial Institute, Great Charles Street, Birmingham, 3, at 7-00 p.m.
- 14th DUNDEE SECTION. A lecture on "How the Money Moves in a Business" will be given by Mr. T. G. Rose, M.I.Mech.E., M.I.P.E., F.I.I.A., at Mathers Hotel, Whitehall Crescent, Dundee, at 7-15 p.m.
- 15th BIRMINGHAM SECTION. A lecture on "Modern Forging Practice" will be given by Mr. J. Sharman at the James Watt Memorial Institute, Great Charles Street, Birmingham, 3, at 7-00 p.m. The Annual General Meeting will follow the lecture.
- 15th EDINBURGH SECTION. The Annual General Meeting will be held, followed by a Discussion, and Supper. The time and place will be announced later.
- 15th LIVERPOOL SECTION. A lecture on "Methods of Protection Against Metallic Corrosion" will be given by Mr. T. A. Evans, F.R.I.C., at Radiant House, Bold Street, Liverpool, at 7-15 p.m.
- 15th MANCHESTER SECTION. A lecture on "Advance in Industrial Heat Treatment" will be given by Mr. J. McHenry, A.M.I.F., A.M.I.T., at the Mechanics Institute, Crewe, commencing at 7-15 p.m.

**March—cont.**

- 15th WESTERN SECTION. A lecture on "Some Aspects of the Fabrication of Welding of Stainless and Heat Resisting Steels" will be given by Mr. F. Jukes, A.M.I.Mech.E., A.M.I.W., at The Grand Hotel, Bristol, at 7-15 p.m.
- 16th GLASGOW SECTION. A lecture on "Effective Use of Material" will be given by Messrs. J. Binnie, A.M.I.P.E., F. H. Perkins, A.M.I.P.E., and J. Platt, A.M.I.P.E., at the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, C.2, at 7-30 p.m.
- 16th MANCHESTER GRADUATE SECTION. A Film Show on "The Manufacture and Use of Tungsten Carbides" will be given by Mr. P. G. Bell, in the Reynolds Hall, College of Technology, Manchester, at 7-15 p.m. This will be preceded by the Annual General Meeting at 6-45 p.m.
- 17th EASTERN COUNTIES SECTION. Annual General Meeting at 6-00 p.m., followed by a lecture on "Developments in Production Engineering in the Eastern Counties Section During the Past Year," at 7-30 p.m., will be held at the Lecture Hall, Electric House, Ipswich.
- 17th COVENTRY SECTION. A lecture on "Some Notable Aluminium Alloy Castings" will be given by Mr. A. R. Martin, at the Greyfriars Rooms, The Geisha Cafe, Hertford Street, Coventry, at 7-00 p.m.
- 17th NORTH EASTERN GRADUATE SECTION. A lecture on "Welding" will be given by Mr. R. B. Williams, Grad.I.P.E., Chairman of the Graduate Section, in the Neville Hall Mining Institution, Westgate Road, Newcastle-upon-Tyne, 1, at 7-00 p.m.
- 18th YORKSHIRE GRADUATE SECTION. A lecture on "Education and Industry" will be given by Capt. G. E. Knight, at The Great Northern Station Hotel, Leeds, 1, at 2-30 p.m. This will be preceded by the Annual General Meeting, which will commence at 2-15 p.m.
- 20th DERBY SUB-SECTION. The Annual General Meeting, which will be followed by films, will be held at the School of Art, Green Lane, Derby, at 7-00 p.m.
- 20th NORTH EASTERN SECTION. The Annual General Meeting, which will be followed by a lecture on "Gear Cutting," will be held at the Neville Hall Mining Institution, Westgate Road, Newcastle-upon-Tyne, 1, at 7-00 p.m.

**March—cont.**

- 22nd LUTON GRADUATE SECTION. A lecture on "Product Packaging" will be given by Mr. J. Evan-Cook, in the Small Assembly Room, Town Hall, Luton, at 7-30 p.m.
- 22nd SOUTH WALES AND MONMOUTHSHIRE SECTION. A lecture on "Efficient Tooling for Production" will be given by Mr. B. Holloway, A.M.I.P.E., at the South Wales Institute of Engineers, Park Place, Cardiff, at 6-45 p.m.
- 23rd LEICESTER AND DISTRICT SECTION. An Address will be given by the Section President, Mr. J. Wombwell, M.B.E., M.I.P.E., in Room 104, The Leicester College of Technology, The Newarke, Leicester, at 7-00 p.m. This will be preceded by the Annual General Meeting at 6-30 p.m. and a film, "Tools for the Job" will be shown at approximately 7-15 p.m.
- 23rd LONDON SECTION. A lecture on "The Effective Use and Selection of Materials" will be given by Dr. R. Genders, M.B.E., D.Met., F.R.I.C., F.I.M., at the Royal Empire Society, Northumberland Avenue, London, W.C.2, at 7-00 p.m. This will be preceded by the Annual General Meeting.
- 24th COVENTRY GRADUATE SECTION. A lecture on "Production on Capstan Lathes" will be given by Mr. R. C. Fenton, M.I.P.E., in Room A.5, Coventry Technical College, The Butts, Coventry, at 7-15 p.m.
- 24th WESTERN SECTION. A lecture on "Jig and Tool Design" will be given by Mr. R. O. Jeakings, at the University College of the South West, Exeter, at 7-30 p.m.
- 25th BIRMINGHAM SECTION. Annual Dinner and Dance at the Botanical Gardens, Edgbaston.
- 27th MANCHESTER SECTION. A lecture on "Valid Incentives (Payment by Results Examined)" will be given by Mr. E. C. Gordon England, F.R.Ac.S., M.I.P.E., F.I.I.A., at the College of Technology, Sackville Street, Manchester, at 7-15 p.m. This will be preceded by the Annual General Meeting at 6-30 p.m.
- 28th BIRMINGHAM GRADUATE SECTION. An afternoon visit has been arranged to Jaguar Cars Ltd., Coventry.
- 28th LINCOLN SUB-SECTION. A visit has been arranged to Messrs. Ruston & Hornsby Ltd., Boultham Works, Lincoln, commencing at 7-00 p.m. This will be preceded by the Annual General Meeting.

**March—cont.**

- 28th LONDON GRADUATE SECTION. A visit has been arranged to C. V. A. Jigs, Moulds & Tools Ltd., Portland Road, Hove, 3, Sussex.
- 28th LUTON, BEDFORD AND DISTRICT SECTION. A lecture on "Diamonds in Industry" will be given by Mr. J. J. Smit, in the Small Assembly Room, Town Hall, Luton, at 7-30 p.m.
- 29th NORTHERN IRELAND SECTION. A film evening and the Annual General Meeting have been arranged to take place at the Municipal College of Technology, Belfast, at 7-00 p.m.
- 29th SHREWSBURY SUB-SECTION. A lecture on "Sand Casting" will be given at the Walker Technical College, Oakengates, at 7.30 p.m.
- 29th WESTERN SECTION. The Annual General Meeting will be held at the Grand Hotel, Bristol, at 7-15 p.m.

## THE BUILDING OF ROLLING MILLS

By M. A. FIENNES, M.I.P.E.\*

*Presented to the Sheffield Section of the Institution, October 10th, 1949*

I do not need to emphasise the essential part which rolling mills play in the production of steel, but I wonder if it is widely known that nearly one half of the total manufacturing capacity in the United Kingdom for rolling mills and kindred heavy engineering equipment, is to-day contained in the City of Sheffield. I wonder, too, if it is generally realised what advances have been made, not only in design, but in the scale of manufacturing equipment over the past ten or fifteen years. Some might say that advances in this country have not been so rapid as in America. If this is largely true it is because the expansion of the American steel industry in the last three decades has proceeded at a much faster rate than in this country.

Improvements in mill design and developments in manufacturing resources arise from the stimulus of demand, and it was not until the British steel industry embarked upon its own programme of re-equipment in the middle thirties, that financial considerations permitted corresponding advances in the steelworks plant industry. It must be frankly admitted that much has been learned from American experience, particularly in the technique of wide strip mills, but whether the origins were indigenous or otherwise, the fact remains that great advances have been made.

While there have been no fundamental changes in the basic principles employed in the deformation of metals, the applications of those principles have been largely perfected in detail, and I want to draw a few rough comparisons to illustrate what these changes have meant to the production engineer.

### IMPORTANT DEVELOPMENTS

Prior to World War 1, and even later, the posts of a blooming mill housing had a cross sectional area of about 250 sq. ins. and the housing weighed about 25 tons. To-day, under the demand for greater production, calling for higher powers and greater roll force, post areas of 550 sq. ins. are common, involving housings of 60 tons or more; indeed, there is to-day a slabbing mill being installed in Great Britain with cast steel housings weighing 125 tons each, with 740 sq. in. posts.

Roll neck bearings have progressed from simple phosphor bronze steps with grease block lubrication, to the various types in common use to-day. These include white metal lined bearings with pressure grease lubrication and internal water cooling; the

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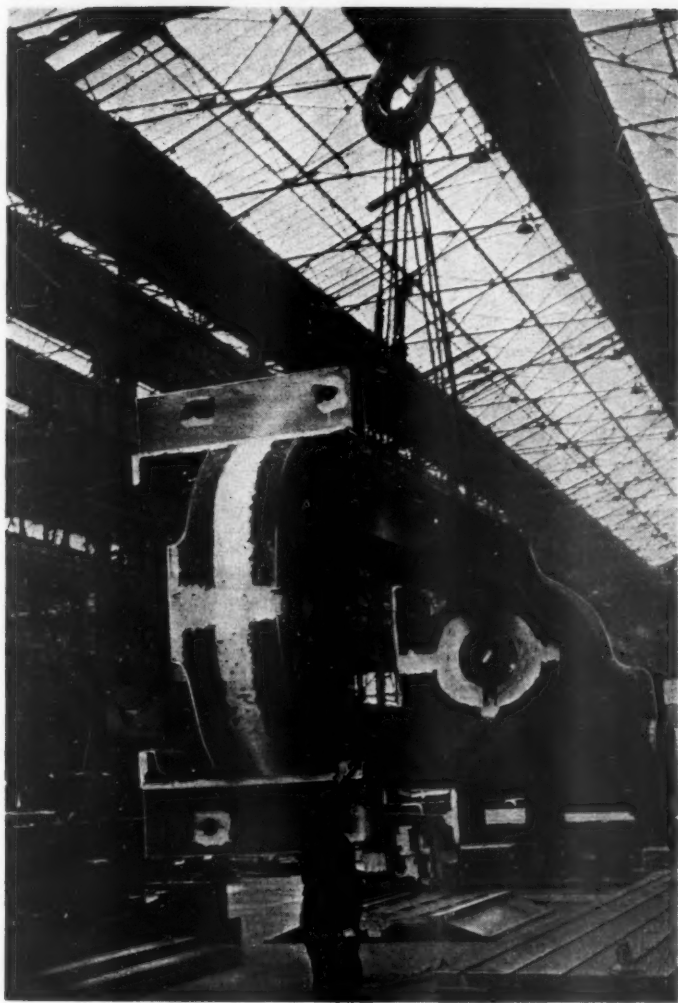


Fig. 1. One of the 85-ton housings for a new three-stand tandem cold mill.

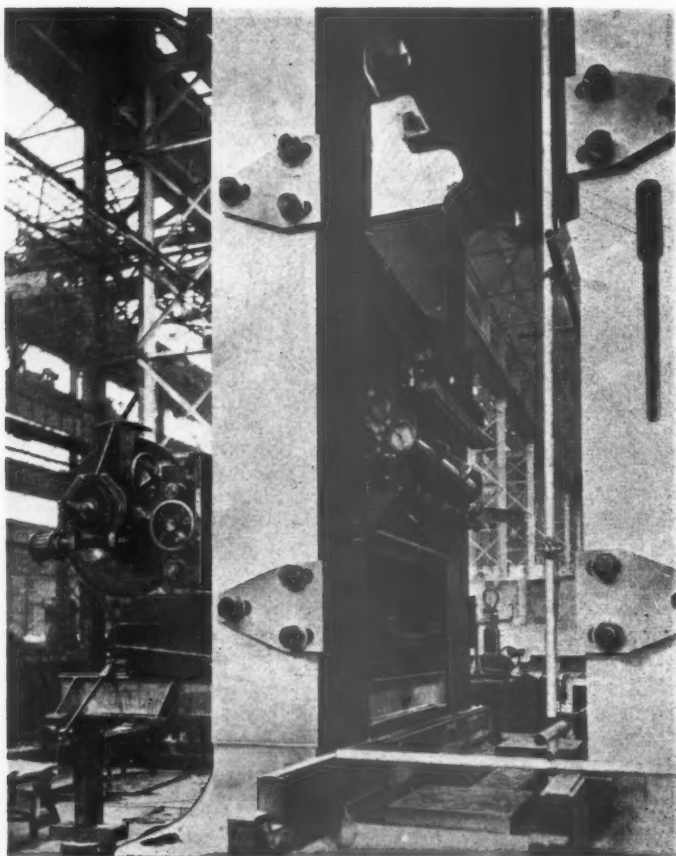


Fig. 2. A further impression of the housings mentioned in the caption for Fig. 1.

fabric bearing with water lubrication ; the flood oil lubricated bearing such as the Morgoil ; and the roller bearing. These developments have not only improved the mechanical efficiency of the mill, but due to the design precautions to prevent ingress of scale, and of water (in those cases where oil and grease are the lubricants), maintenance costs have been greatly reduced. Above all, the modern roll neck bearing is designed with a view to rapid

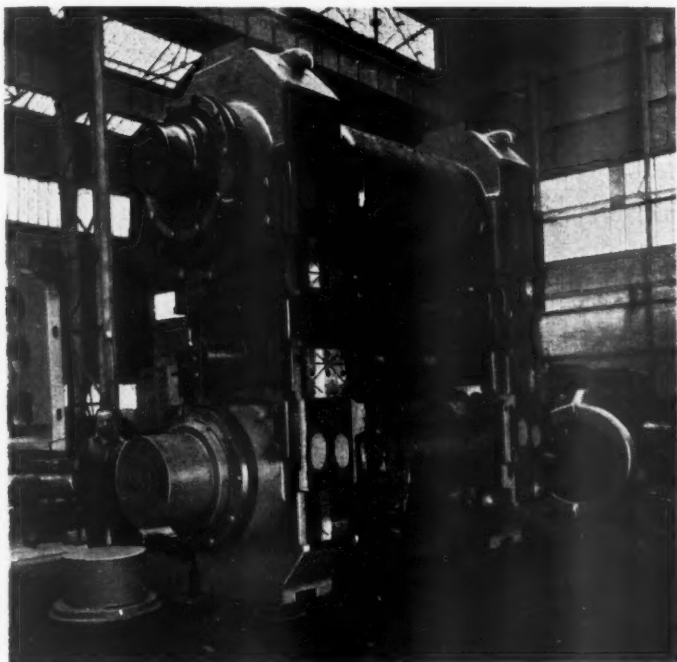


Fig. 3. Chock and roll assembly for an 80" wide 4-high reversing cold steel strip mill, from delivery side. Work Rolls are 20½" dia. ; back-up rolls are 53" dia. and fitted with Morgoil bearings. The total weight of this assembly is 145 tons 18 cwt. Each back-up roll and its pair of chocks weighs 66 tons ; each work roll with its pair of chocks weighs 6 tons 19 cwt.

roll changing, the time for which has in many cases been halved.

Mill drives have similarly improved. Couplings are now of the fully machined universal type, totally enclosed with oil spray lubrication. Mill pinions have progressed from cast teeth 5" or 6" pitch enclosed only by a sheet steel guard, with heavy grease daubed on by hand, to the modern arrangement with forged steel, machine cut, medium pitch, double helical pinions, in a totally enclosed housing with circulating oil lubrication.

I could quote many more examples. In general, improvements have been directed towards greater rigidity, thus enabling the mill to withstand shock loads without excessive wear on the moving



Fig. 4. Coupling, pinion housing and spindle set-up in a modern 42" blooming mill.

parts; reduced power consumption by accurately produced bearings throughout, either of the roller or flood lubricated sleeve types; and above all towards reduced standing time, both in respect of roll changing and maintenance. As an example of the success achieved in this direction, there is the case of a blooming mill built at the end of the First World War and the modern mill which replaced it on the same site some five or six years ago, operating under similar conditions, although at about 20 per cent higher output. In this case the roll changing time has been reduced from four hours to two hours and the routine maintenance time from around 3 per cent of the rolling time on the old mill, even in its prime, to .2 per cent on the modern milling to-day.

#### **SPECTACULAR CHANGE**

The most spectacular revolution, however, lies in the production of thin flat rolled stock. The broad facts are well known, but a few simple examples will show the magnitude of the change.

If anyone were so rash as to construct a pathway over the 420 miles from London to Glasgow made of 14 gauge sheets 72" wide, it would take about 45,000 man-hours to roll the material from the

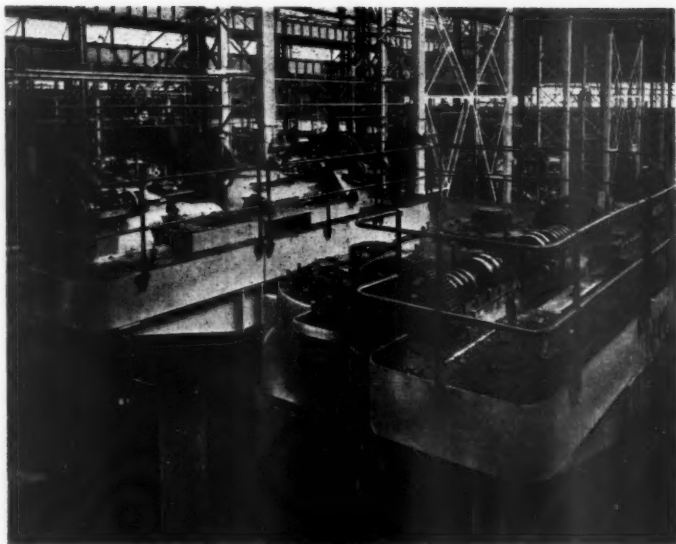


Fig. 5. The screw-down gear on a new 66" wide three-stand tandem cold aluminium strip mill.

sheet bar on the old type of hand sheet mill. If the same material were rolled from slabs on a modern continuous hot strip mill it would take about 3,500 man-hours, or about  $7\frac{3}{4}$  per cent of the time.

An old type jobbing sheet mill would produce under average conditions less than half a ton of sheets per man-hour. A modern hot strip mill can produce nearly  $5\frac{1}{2}$  tons of similar material per man-hour.

A 5-stand tandem 4-high cold mill can produce 415,000 tons per year of tinplate, .010" thick  $\times$  28" wide and that production would require 36 to 40 men to operate the mill. On the old type of Welsh tin mill, the same production would require 130 mills, each comprising a roughing and a finishing stand; and over 3,000 men would be required to operate them, most of them doing manual work of a most arduous character.

If these figures are staggering, I would point out that cold strip mills are to-day finishing tinplate strip at speeds up to 5,000 and 6,000 feet per minute, and there is no comparison between the qualities of the product both in accuracy and in finish. Greatly improved accuracy, indeed, has accompanied this revolution in



Fig. 6. The test load on a 125 ton crane during the final building of the Groups' latest erection bay, No. 6 Bay at Darnall Works.

production. In rolling tinplate, say .010" thick  $\times$  28" wide on a 5-stand tandem cold mill, the variation in thickness from middle to side can be controlled to within .0005", and over the length of a 10 ton coil, the variation can be kept within .001".

These achievements have been made possible not only by the employment of great power, but by designs of great strength and by the application of modern standards of accuracy in manufacture. The old 2-high hand sheet mill had roll housings weighing around 18/20 tons. The modern 4-high strip mill has housings ranging up to 100 tons. The old mill had roll necks with phosphor bronze steps and extremely simple cast steel chocks weighing perhaps a few cwts. The strip mill has work roll chocks carrying roller bearings housed with extreme precision and back-up roll chocks with roller or flood oil lubricated bearings, weighing anything up to 15 tons. The chocks I have in mind, incidentally, are no less than

9' 4" in height  $\times$  5' 10" wide. You look up at them instead of down. Simple hand screw down has given place to electric screwing with Ward-Leonard control, and there is a whole host of other refinements, many of which have no counterpart in the older mills.

Whereas, on a two-high sheet mill clearances of  $\frac{1}{8}$ " or so were common between the chocks and housings, the back-up chocks on a strip mill are allowed a clearance of .020" on width and the work roll chocks .010". The housing windows must be square both horizontally and vertically to within .004"/.005" and the relative centres of the work roll and back-up roll chock bores must be vertically lineable to within .0015". And note, please, that these degrees of accuracy must be obtained on pieces weighing up to 100 tons in the case of housings and up to about 15 tons in the case of chocks.

#### **CORRESPONDING PROGRESSION**

The corresponding development of auxiliary machinery has also been an essential factor. The auxiliary equipment includes reels, wrappers, coilers, uncoilers and a host of other items, and because it is by comparison with the mill proper fairly light, it constitutes a rather different production problem.

Now my purpose in quoting these examples is not primarily to extol the good qualities of modern mills. I have called this paper, "The Building of Rolling Mills" and if I have apparently digressed from the outset, it is because I want to demonstrate the evolution which has taken place in design and to show the kind of Frankenstein monster which the joint machinations of the mill designer and the steel works engineer have thrust upon the patient production engineer.

The fact is that a corresponding evolution has taken place in rolling mill production and the mill builder has progressed from a plodding millwright to a competent precision engineer. The mill builder to-day is not only a precision engineer *per se*, but a specialist in the accurate production and assembly of very heavy pieces.

All these changes in design have brought in their wake great changes in the works and organisation of the builders and I want to describe to you some of the factors which, under to-day's conditions, enter into rolling mill production. In doing so I shall inevitably be describing some of the developments within my own Company.

#### **ESSENTIAL REQUIREMENTS**

The first necessity for modern rolling mill production is the availability of machine and erecting shops capable of supporting overhead cranes which can lift 100 tons or more. About 50 feet from floor to crane hook is desirable and experience shows that on heavy work a span of much less than 70 feet is liable to cause congestion. Indeed, some of the larger mills require about 80 feet for complete erection.

# THE BUILDING OF ROLLING MILLS



Fig. 7. The completed No. 6 Bay takes the load in four different mill installations building simultaneously. In the right foreground is a single stand 4-high 80" wide reversing cold sheet and strip mill at present being installed at Port Kembla, New South Wales, and which will be the largest cold steel rolling mill in the Southern Hemisphere; to the left are two stands of a new three-stand tandem aluminium cold mill; beyond that can be seen the housings of 42" reversing blooming mill and further back a 19" Morgan continuous billet mill designed to work in conjunction with it.

Within these shops the machine tools for fashioning the heavy pieces are situated, and having regard to the accuracy of finish required they must themselves be of massive construction. The capital cost is, therefore, heavy, but it is my experience that you generally get what you pay for, and on this class of work anything in the least flimsy in the way of machine tools simply does not pay. Not only must the machines themselves be rigid, but their foundations and those of the work tables must be correspondingly massive. I have particularly in mind the 700 ton foundation under a heavy planer which itself weighs 270 tons and which can carry a load of 100 tons on the table. The 300 h.p. drive treats this load as a plaything, but the rapid table reversals obviously place high demands upon the foundation.

Probably the most useful general purpose tool in these shops is the heavy duty floor type horizontal boring, milling and facing machine. It will machine round surfaces both internally and externally. It can gash and it can machine flat surfaces. It can drill and it can screw cut. Moreover, it can do these things over a wide area in the vertical plane and it affords the maximum accessibility to the operator. There never seem to have been enough of these machines in the past, but I believe the insistent demands of the production engineers are now within sight of being satisfied. Spindle diameters ranging from 6" to 10" are the most useful and while many of them were originally put in for boring work, they are being progressively used to an increasing extent on facemilling. Improvements in the machinability of heavy steel castings and the rapidly increasing use of weldments have combined to make this economical in terms of cutter cost.

**PROBLEM OF COST** As I have said, the capital cost of these heavy machines is high and like the rolling mills they help to make, they only earn their keep when they are producing. The accountants tell us that when they stand idle they are actually losing money. One of the problems in their economic operation, therefore, is to keep them cutting to the maximum possible extent. With the best will in the world they cannot cut all the time, because the accurate setting up of a heavy workpiece is frequently a lengthy operation involving some hours; and this difficulty is intensified if the worktable is only large enough to accommodate one work piece.

To minimise idle machine time, we have under construction a new set-up which, while not novel in principle, I believe to be new to rolling mill construction in this country. It is obvious that time will be saved and cost improved if the number of settings of heavy workpieces can be reduced. Moreover, some of these workpieces are heavier than the machines which work on them, so it becomes

economical in many applications to bring the machine to the job, rather than the job to the machine.

To achieve this, a large and massive cast iron floor plate is being laid down on a deep foundation, covering an area about  $130' \times 60'$ . The bed is in sections and the individual sections are carried on jack screws for adjustment. We expect the surface to be laid down and to be maintained within a tolerance of .005" across the area, and the design is such that deflection should be negligible under the heaviest loads envisaged.

Along one side of this plate three large horizontal borers are being installed, two having  $8\frac{1}{2}"$  diameter spindles and the other  $7\frac{1}{2}"$  diameter. These have their own slideway beds mounted on an extension of the workplate foundation and their combined longitudinal traverse is such that the greater part of the  $130'$  side of the workplate is potentially swept by boring and facing spindles. On the worktable itself, several portable machines will be mounted. I call them portable even though some of them weigh 40/50 tons, because they have large stirrups on the columns for easy lifting by the 100-ton overhead crane with which the shop is equipped. There will be two portable horizontal boring and milling machines having 6" and 7" diameter spindles; a portable column type shaper of considerable range; a smaller shaper, and one or two other lighter tools. All these machines can be bolted down to the Tee slots in the worktable wherever they may be required to operate.

The mode of working envisaged is that while, say, a borer is working on one piece, the next piece is being set up, if necessary on a distant part of the worktable, and to this the borer is ultimately removed. The place of the borer on the first workpiece is then taken in suitable applications by, say, the column type shaper, without any further setting of the workpiece. In the case of the three bores located on foundations at one side of the bed, the longitudinal traverse available is such that in most cases the next job can be set up in readiness alongside the piece actually being worked upon. Apart from reduced machine idleness and reductions in setting times, it is also expected that in some cases it will be possible for two machines to work on the same piece simultaneously.

#### **PLACE FOR SMALLER MACHINES**

I do not want to give the impression that these heavy machines represent the whole sum and substance of rolling mill building. They pose the most individual problem in respect of accuracy on a large scale and they require the most careful organisation for maximum output and economy, but in any rolling mill there are numerous smaller parts and these tend to multiply as design developments evolve more and more complicated auxiliary equipment. In



Fig. 8. The completion of the 42" reversing blooming mill in No. 6 Bay, Darnall Works. The pinion housing and spindles have already been dismantled and despatched for installation on site.

consequence, the smaller and medium machines occupy a place in the scheme of things which is of the highest importance.

It is a feature of this kind of engineering that, even on the smaller parts, there is little or no work which can be classed as repetitive. Each mill is individually designed around a particular set of operating conditions and it is very rarely that a plant designed for one steel works is directly applicable to another. While, therefore, a good deal of work has been done on component standardisation, the machine shop operations as a whole are characterised by short runs. It follows that the equipment provided is mostly of general purpose type and comprises the conventional lathes, horizontal and vertical borers, planers and plano-millers, vertical milling machines, radial drills and so forth. It is perhaps worth noting, however, that the

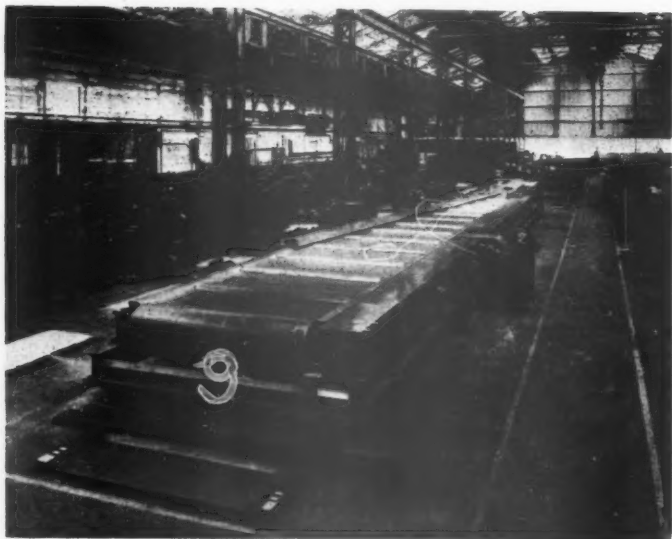


Fig. 9. An example of medium weight erection work as carried out in No. 2 Bay at Darnall Works.

increasing use of anti-friction bearings in such applications as roller tables and drives is calling for a greatly extended use of grinding as a method of accurate sizing at economical cost, particularly on long shafts.

At all events, this kind of machining is not a good medium for the production engineer in the more obvious field of devising special manufacturing equipment such as jigs and tools. That, however, is not to say that there is no place for him — far from it. The emphasis, however, lies in rather different directions and I would say that the two principal avenues of approach to efficient production lie, firstly, in good design for manufacture ; and, secondly, in good shop organisation.

#### **LIAISON BETWEEN DESIGN AND PRODUCTION**

Take the first point. The designer-draughtsman, quite naturally, looks to functional design as a prime consideration. He is anxious to ensure that his machine will give the best possible account of itself in service, and rightly so. But in the past there has been some tendency to overlook the production difficulties which arise from complexity, many of which can be eliminated by a truer appreciation

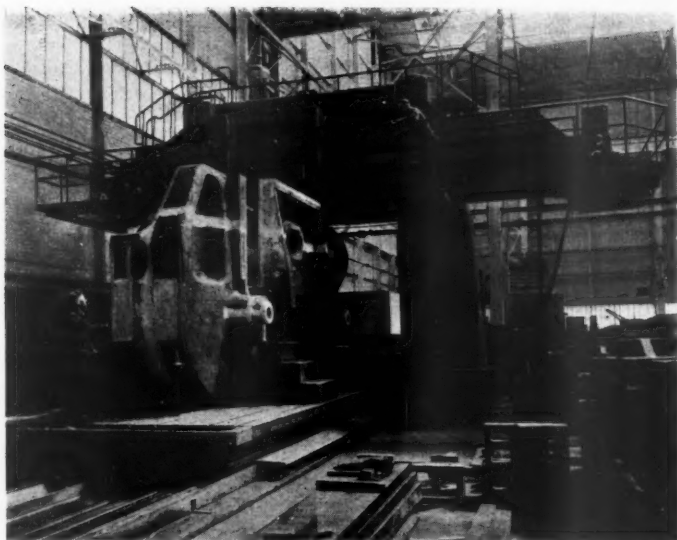


Fig. 10. Heavy machining in the 69 tons frame of a 900 tons slab shear on a giant planer in the Darnall Works. This planer itself weighs 270 tons and can take a job of 120 tons weight on the table. This machine is equipped with two tool boxes on the cross slide and one side tool box on each vertical slide and is also provided with a milling head.

of exactly what happens in the shops. There are, for instance, classic examples of needlessly complicated castings, of elaborate machining operations called for, the cost of which is out of all proportion to the value achieved, and so forth. There is also, in many drawing offices, an insufficiently practical understanding of the meaning of dimensional tolerances and one sees the consequence, either in unnecessarily fine limits being specified, which mean much cost in the machine shop, or in limits which are too wide and which result in expensive corrective measures during erection, which incidentally have the additional effect of delaying production.

In repetition engineering, many of these problems are commonly solved by trial and error on the shop floor and it is possible to make progressive improvements in method as the job proceeds. In the "one-off" type of jobbing production of which I speak, this is not as a rule practicable. It is now fairly common practice for detailed operation planning to be carried out on modern lines before production starts, so that sequence and method are established before the

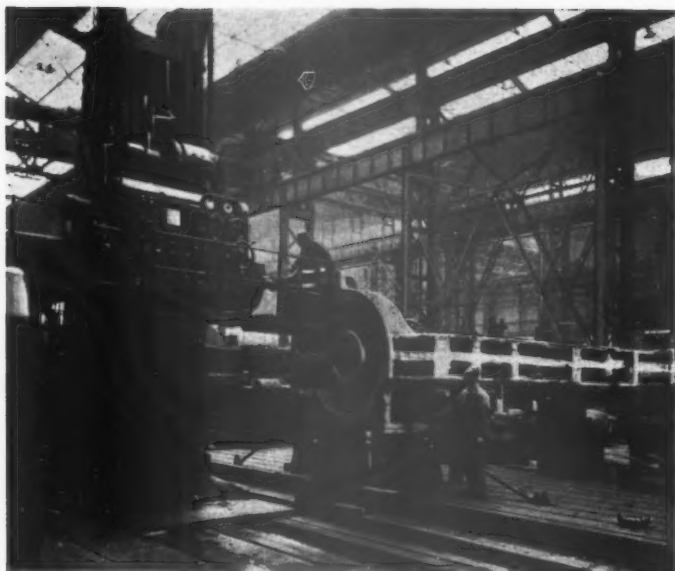


Fig. 11. A 62 tons roll housing on one of the horizontal boring, milling and drilling machines in the heavy machining section of the Darnall Works. This machine has an  $8\frac{1}{2}$ " dia. spindle ; the spindle extension is approximately 5' 10". It has two concentric spindles, the inner one being a high-speed spindle for drilling. The horizontal traverse of the column along the bed is approximately 29' 6" and the vertical traverse of the slide on the column is approximately 14' 9", enabling large jobs to be milled or bored at one setting.

material comes on to the machine shop floor, but this does not provide the whole answer. The operation planner works, as a rule, from the drawing before him so it is desirable to interpose some filter to ensure that design is economic before the drawings reach the processing stage.

I hold that all cost is initially generated in the drawing office and that it is vitally necessary to trap this form of potential waste at its source. In my own Company we have considered this to be so important that we have taken our most experienced production engineer off routine duties altogether. While he now has a general roving commission to eliminate waste, we have deliberately located him next to the drawing office so that he is available to influence design for production in the formative stages, that is, before the drawings leave the drawing office. This policy is yielding good

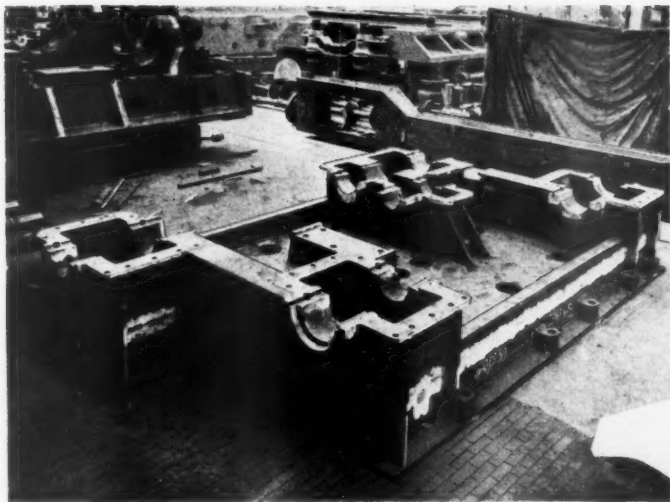


Fig. 12. The use of weldments. An 11½ ton beam box bedplate for the main manipulator drive on a 42" blooming mill. The construction of this bedplate is interesting as it incorporates steel castings in the form of bearing blocks for carrying the main manipulator driving shafts.

results. In the case of one recent rolling mill project we made a concerted attack on this problem of economic design. The attack was first concentrated on the elimination of unnecessary weight. In this the extensive use of weldments played a major part, enabling the essential weight to be put in the right places; then we tackled the standardisation of various components, but in doing so we paid meticulous regard to designing for the lowest possible production cost consistent with functional purpose. The result showed an overall saving of no less than 15 per cent in estimated cost compared with the original project, on a mill comprising about 3,500 tons of machinery. We regarded the result as rather gratifying. So, incidentally, did the customer, to whom we magnanimously transferred at least the lion's share of the benefit. As is well known, mill builders are an altruistic breed.

In case there are any expectant steelmakers present, I should perhaps explain that the scope for cost reductions on this scale is fairly limited. On the mill in question there were very considerable lengths of roller tables lending themselves to component and unit standardisation, and offering some unusual opportunities for



Fig. 13. Welding a gear box for a double reduction turbine gear.

production in fair batch quantities which warranted some expenditure on jigs and tools. Nevertheless, although the possibilities are quite substantial on the general run of rolling mill work, I should, perhaps, put the matter into its proper perspective by pointing out that, taking a broad average, some 60 per cent of the cost of a mill is represented by purchased materials. This lends importance to the economic use of materials, but my point is that the task of the production engineer is directed to a limited proportion of a total cost.

#### SHOP ORGANISATION

I want now to refer to shop organisation. A modern rolling mill installation is a massive affair. A continuous hot strip mill with its auxiliaries may amount to 20,000 tons of machinery. A blooming mill plant may weigh 3,000 tons or more. A recent contract consisting of a blooming

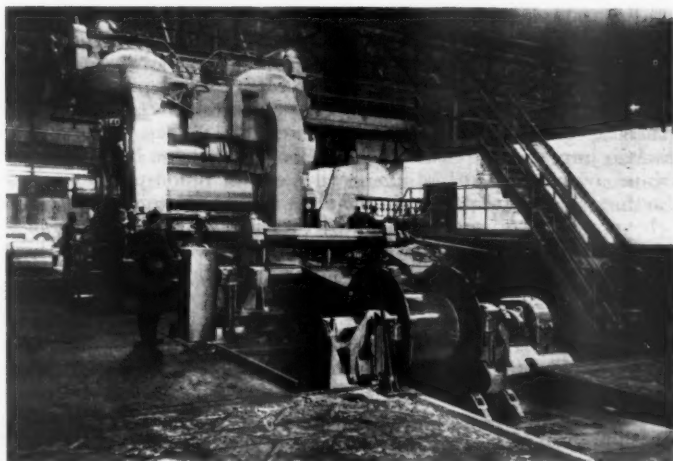


Fig. 14. A modern 20½" and 53" × 80" 4-high reversing cold mill. Rolling strip up to 74" wide in coils up to 10 tons in weight, this is the largest mill of its type in Britain.

mill and continuous billet mill comprised about 9,000 parts and these in turn involved about 45,000 machining operations. At any time of peak demand there will be several such contracts in progress, all of them different in character, all of them in different stages of manufacture. From this factor, many problems follow.

One of the most difficult is that of material movement, or more concisely the job of getting the right stuff to the right place at the right time. It starts, of course, with materials purchased from outside. If these arrive too soon you get congestion in storage spaces, though that does not happen frequently these days. If they are too late they upset production programmes. That often happens. The stakes are sometimes high. If, say, an 80-ton roll housing is scrapped during casting, it may take four to six months to obtain a replacement and an intricate and carefully devised programme goes out of the window. At all events, you inevitably have on your hands a vast amount of diverse material and it is the easiest thing in the world to get it all "round your neck." The effective control of material movement is therefore a vital necessity and in my experience there are three main aspects of the problem.

First, it is essential to have adequate storage accommodation and we have developed, in effect, a series of stores through which work

passes and is kept under proper control in its successive stages, thus : rough material store, work-in-progress store, and finished part store. Stores are so important and I am not sure that we always recognise the fact in this country. One has so often seen engineering works built without adequate thought being given to stores problems and their integral part in most production chains. Then you find them hastily improvised. Someone has to look after them, but it is a tiresome overhead expense—generally called “non-productive”—so that the dullest labourer in the place is put in charge because he is cheap, and then firms wonder why they lose some of their valuable assets. That may be an overstatement to-day and I certainly hope it is, but it was certainly not uncommon even before the last war.

Secondly, there is effective administrative control of material movement. Someone has to *direct* that on certain days certain parts must be moved from the rough material store to the machine shop. Someone must *direct* the movements within the machine shop. Someone must *direct* the movements out of the finished part store into the erecting shop and so on. This implies a control organ, but it is important that in a large works at any rate, control should not be over-centralised. It should also be noted that no paper control can operate unless the parts themselves can be physically identified, so that the proper marking and location of components is vital.

Thirdly, there is the obvious, but nevertheless important matter of ensuring that where large volumes of materials have to be moved, the physical equipment is provided for the purpose. We have developed battery driven, rail mounted electric bogies for inter-bay transport of pieces up to 10 tons. Over that weight we use a heavy 150-ton bogie moved by the works diesel locomotive. For the lighter loads we use battery trucks, but the most useful tool we have yet found for this work is the fork-lift truck which by its versatility and manoeuvrability, has solved innumerable problems and cut out much double handling.

There is another objective associated with good shop organisation. When I see machines standing idle I generally find it is because the workman is looking for something. Either it is a drawing, or it is a tool or something else connected with the job on hand. Skilled labour is a valuable commodity these days and no one can afford to waste it on unskilled jobs. Shop organisation should be such, therefore, that when a man is given a job to do, he is also provided at the same time with all the things with which to do it—the material, the drawing, the tools and the job card. This may sound obvious and easy and on some classes of repetition production it is not difficult, but on short run work in a large factory it involves no mean problem of organisation if it is to be done at reasonable cost. Indeed, it is necessary to preserve a sense of proportion and not allow overhead expenses to run away in the pursuit of some of these

desirable objectives. The cost, however, must be weighed all the time against the paramount importance of keeping expensive capital assets producing for the maximum proportion of their life.

This leads me to another point. I believe that in this country we treat our machine tools too tenderly. In America they are driven all out and if they wear out quickly they have probably earned their replacement cost many times over. Such an outlook on machines should improve productivity materially. I consider it a reproach to have a machine tool twenty years old and still "as good as new."

#### NEED FOR SELECTIVITY

Before I close, I want to deal with one other aspect of rolling mill production. In the manufacture of custom built machinery of this kind, it is an eternal problem to keep one's plant in a proper state of operating balance. It hardly ever works out exactly right. At one period there is too much heavy work and not enough light. Then in a few months it all swings round the other way. Then you find the boring machines are overloaded, but there is not enough work for the lathes. And so it goes on. It is necessary, therefore to be selective at times regarding contract commitments assuming, of course, that any choice exists. But such selection has frequently to be made in the light of conditions estimated to come about in two or even three years time.

Added to this, there is the problem of accurately forecasting delivery dates in a jig-saw pattern of jobs on which the production time cycle is sometimes as much as two years. We have found it necessary, therefore, to have in addition to the immediate tactical control of shop floor operations in each works, an overall strategic control which we call the contract department. This department has to keep before it under constant review the fluctuations in the state of load in each of the main productive units and that includes not only the works departments, but the drawing office also. Because most rolling mills are individually designed, a high proportion of new drawings is required for each job. Without drawings, the works cannot function, so a balanced output of drawings is an indispensable necessity. Moreover, the drawings must be produced in the sequence required by the shops, because within limits the pattern set by the drawing office is ultimately reflected in the shops. The drawing office is in fact the first in the chain of production departments.

The relating of load to capacity in each department, and the maintenance of balance, are the bases from which long range delivery promises are quoted, and the ultimate scheme of operations has to be based upon much the same planning when an order is received. It is a highly complex task, involving the exercise of much experienced judgment, because at the time these forecasts

have to be made, the job is not as a rule designed in detail. We try to keep these problems away from our works management in the early stages and we use our estimating department to provide the basic information. Their task, in fact, is not only to forecast the cost of a job, but to estimate its *work content*, in terms of man-hours in different departments, and in the case of the machine shop, in various categories of machine tools also.

**SETTING OBJECTIVES** The contract department takes these figures, allocates the load amongst the various works in the group according to capacity available and then sets monthly objectives for each department in respect of all major contracts, in such a way as to spread the load in practical terms over the period allowed. The sum total of these monthly objectives on contracts in progress equals the capacity of the respective departments, after making allowance for small orders and for contingencies. Having set these objectives, the contract department then observes physical progress in relation to them and is in a position to report or take action on deviations from programme soon after they occur.

All this may sound very elaborate and to some extent it is, but it is an elaboration born of industrial growth. In the old days when operations were on a smaller scale it was generally possible to see what was happening by visual evidence. The scale of things to-day renders that impossible and statistical control has to take its place. Similar developments have taken place in America, where much the same methods are applied. It is no use waking up one morning when a mill ordered eighteen months ago is due for delivery only to find that some vital drawing has been forgotten, or that someone has omitted to order a casting—all of which may add up to another six months' delay. Your customer, with a nice new steelworks nearly ready, will not be very pleased. It is essential to know the facts as they occur and to be able to assess the consequences of those facts, so that action may be taken at the right time—this I believe lies at the root of successful organisation in heavy engineering.

## Notes

## Notes

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DIE-CASTINGS**

**This time  
it's about  
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ALL HOLES AND DIMENSIONS CAST TO CLOSE LIMITS WHEN REQUIRED

**WOLVERHAMPTON DIE-CASTING CO. LTD.**

GRAISELEY HILL WORKS · WOLVERHAMPTON.

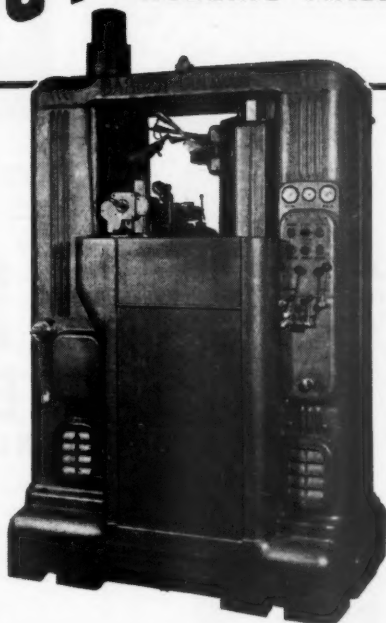
*Introducing the*

**BARBER-  
COLMAN**

**NO 8-10**

*Vertical*  
**HOBGING MACHINE**

This machine, which has a capacity of 8" diameter by 10" long and an outstandingly rugged construction, is designed for high speed production of spur or helical gears or splines. Rigid arch-type casting, extra long vertical ways, which align the work slide, heavy short-coupled drive shafts and broad faced helical and bevel gearing, provide smooth powerful operation and minimum distortion of machine members even under the heaviest cuts. This extra-heavy structure plus accurate mounting of the hob



on the taper hob spindle, ensures consistent accuracy while the machine maintains a high output, even through day-in day-out operation. Effortless control is provided by the handy centralised panel, from which a lever sets in motion the machine's semi-automatic cycle. A simple selector regulates the 8—10 to either climb or conventional cutting. Increases in hob life ranging up to 50% are achieved by fitting the new Barber-Colman 8—10 Hob Shifter.

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**BARBER & COLMAN LTD., MARSLAND RD., BROOKLANDS, MANCHESTER**

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Telegrams : "BARCOL" SALE

*of interest to all  
PRODUCTION  
ENGINEERS*

IT'S CHEAPER TO USE MILLS LEDLOY STEELS



BALL RACE

INCREASED PRODUCTION	INCREASED TOOL LIFE
66%	30%



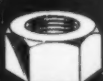
SET SCREW

INCREASED PRODUCTION	INCREASED TOOL LIFE
62%	300%



GREASE NIPPLES

INCREASED PRODUCTION	INCREASED TOOL LIFE
54%	300%



NUT

INCREASED PRODUCTION	INCREASED TOOL LIFE
45%	50%



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INCREASED PRODUCTION	INCREASED TOOL LIFE
25%	300%

## MILLS LEDLOY BRIGHT STEELS

Possessing greatly increased machinability over ordinary steels are supplied in all standard sections and sizes and many special shapes, in Free Cutting, Case Hardening, Carbon, Heat Treated Carbon and Alloy qualities.

EXORS OF JAMES MILLS, LTD.  
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*Extruded rods and sections of non-ferrous alloys in illimitable variety, reducing machining costs.*

### STAMPINGS

*Hot Brass and bronze stampings of superior finish and closeness to size, cutting down production time and often almost entirely eliminating machining.*

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*Solid or cored, in Phosphor Bronze and Gun Metal, cast in machined moulds, saving material, tools and labour.*

### NON-FERROUS INGOTS

*(including Anti-Friction Metals for bearings) cover every need of the brass foundry. Produced to guaranteed analysis.*

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metal technique

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Excuse our enthusiasm  
but to us  
these  
parts  
are greater  
than  
this whole



ZINC CAN HELP in form room as well as factory. Thus it contributes essential parts to this globe,\* produced in large quantities for home and export markets.

#### Why the parts are zinc alloy die cast

The pivots on which the globe revolves are die cast in zinc alloy (and would that world affairs went round as smoothly as this globe!) The thin meridian, too, is zinc alloy die cast, because zinc alloy is specially suitable for casting very thin sections, and the meridian can be made with raised degrees of latitude cast on it. Finally, the base is a zinc alloy die casting. The globe is made in  $13\frac{1}{2}$  in. diameter (with other sizes to follow) and die cast parts are given a gilt finish.

#### Other educational uses

Zinc alloy die casting is also used for minutely accurate quantity production of microscope frames, projector parts, lantern parts, epidiascope parts, film viewers and drawing instruments.

#### Some facts about zinc alloy die casting

Speed is the essence of the die casting process — the shortest distance between

raw material and finished product. Zinc alloys are the most widely used metals for die casting because they ensure:

**STRENGTH:** Good mechanical properties for stressed components.

**ACCURACY:** Castings can be made practically to finished dimensions and need little or no machining.

**STABILITY:** Close tolerances are maintained throughout the life of the casting.

Hence the widespread war-time use of zinc alloy die casting for fuses, gun sights, periscopes, tank carburettors, etc.

#### British Standard 1004

Alloys conforming to B.S.1004 should be specified where strength, accuracy and stability are essential.



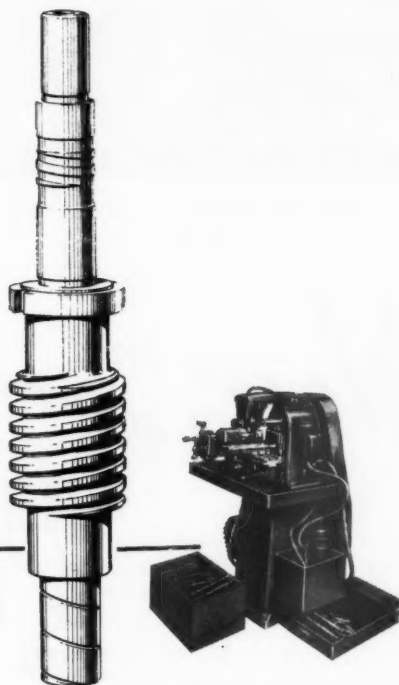
ZINC ALLOY DIE CASTERS ASSOCIATION  
LINCOLN HOUSE, TURL STREET, OXFORD.  
TELEPHONE: OXFORD 48088.

**ZINC ALLOY DIE CASTINGS PLAY AN IMPORTANT PART IN THE EXPORT MARKET**

Enquiries about the uses of zinc alloy die castings are welcome. Publications and a list of Members will be sent on request.

\* Photograph by courtesy of George Philip & Son, Ltd.

Thread  
milling on  
a modified  
**AJAX AJ8P**  
miller is  
profitable



Cutting time 9 minutes each  
for these 40-ton Carbon Steel  
Wormshafts:  $1\frac{1}{2}$ " O.D.,  $1\frac{1}{2}$ "  
long,  $\frac{1}{2}$ " pitch, 2 start thread.

#### AJ25P FOR THREAD MILLING

You'll find no better milling machine for relieving bigger machines and for producing accurate work at high speeds with unskilled labour. It cuts toolroom costs too. Write for particulars to Ajax Machine Tool Co. Ltd., Halifax, Yorks.

*General Specification of standard AJ8P.*

- ★ Rack and pinion or screw feed.
- ★ Micrometer dial for transverse feed.
- ★ Feed lengths: 8" longitudinal,  $3\frac{1}{2}$ " transverse,  $6\frac{1}{2}$ " vertical.
- ★ Table surface  $16" \times 4\frac{1}{2}"$ .
- ★ Maximum distance spindle centre to table  $6\frac{1}{2}"$ .
- ★ Arbor diameter 1".
- ★ 4 speeds in each of four alternative ranges.
- ★ Push button control of  $\frac{1}{2}$  h.p. motor.

**AJAX**

# G.P.A.

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accept your enquiries  
for*

## JIGS • FIXTURES & GAUGES

PRESS TOOLS • MOULDS AND  
SPECIAL PURPOSE MACHINES

*of all kinds*

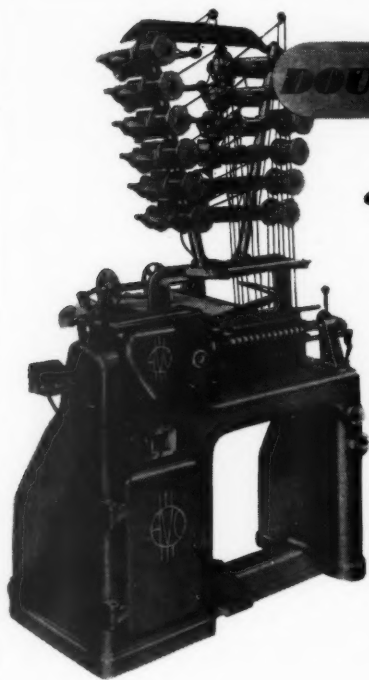


Up-to-date shops specially laid out and equipped for making, on a production basis, every type of precision ground gauges; limit snap, form, calliper, taper and special purpose gauge, as well as jigs and fixtures of all kinds, press tools, moulds and special purpose machines. Highest class workmanship and accuracy guaranteed.

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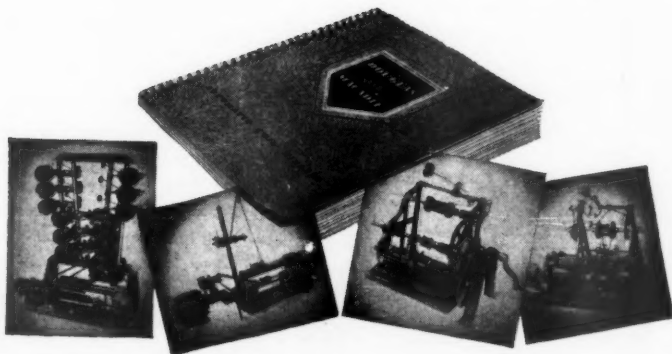


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*Automatic*  
**COIL WINDERS**

The large illustration depicts the improved "Douglas" Fully Automatic Multi-Winder, specially developed for the high-speed production of large quantities of coils with or without paper interleaving. It will produce round, square or rectangular coils up to 6" each in length and up to  $4\frac{1}{2}$ " diameter. As many as 12 smaller coils can be wound simultaneously within the total available winding length of 12 inches, at headstock speeds of between 600 and 2,000 r.p.m.

*Twenty-two different Coil Winders and Taping Machines are illustrated in our Catalogue, a copy of which will be sent to interested executives on application.*

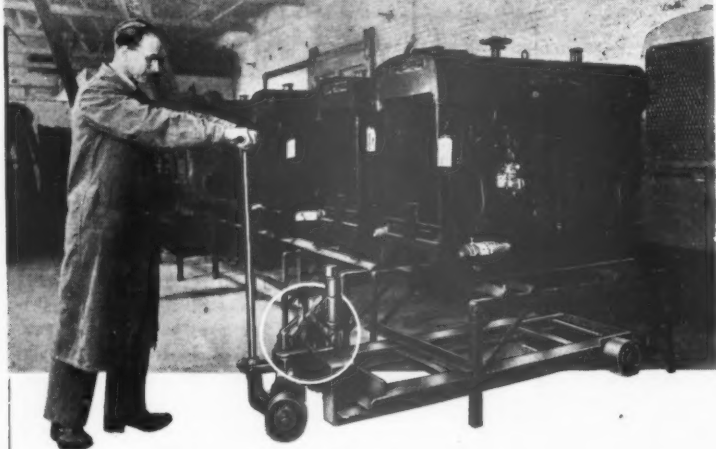


**THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.**  
Winder House, Douglas Street, London, S.W.1.

Telephone: VICTORIA 3404-9

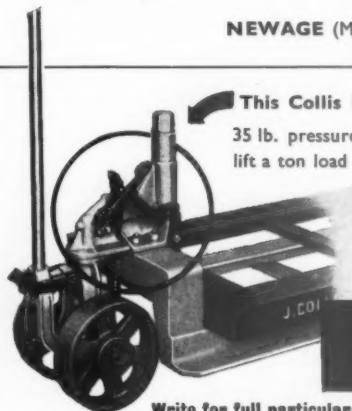
# THE COLLIS TRUCK

saves valuable time and labour



**'The ease and simplicity in handling The Collis Truck enables us to move all types of generating sets of all sizes quickly and easily, thus saving valuable time and labour in the process.'**

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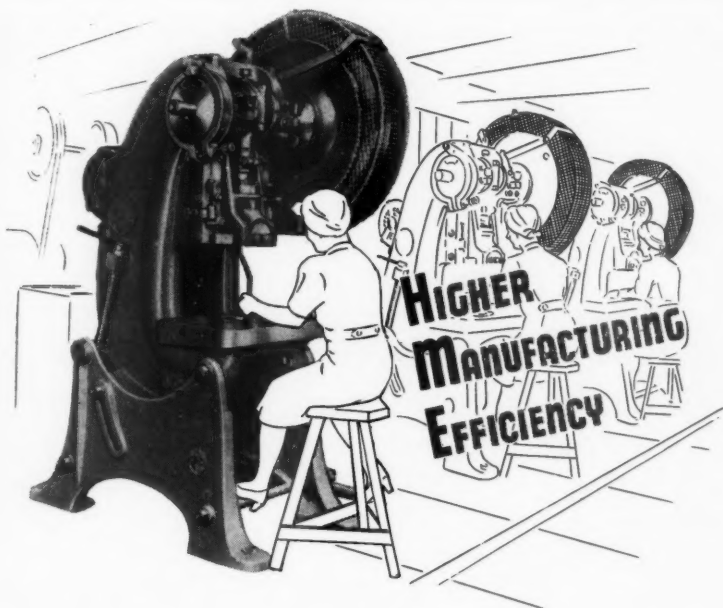
**This Collis Hydraulic Unit lightens the load.**

35 lb. pressure on the handle is all that is needed to lift a ton load on The Collis Truck (Hydraulic model).

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Models range from 3 to 300 tons capacity.

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'PROLITE' CEMENTED TUNGSTEN  
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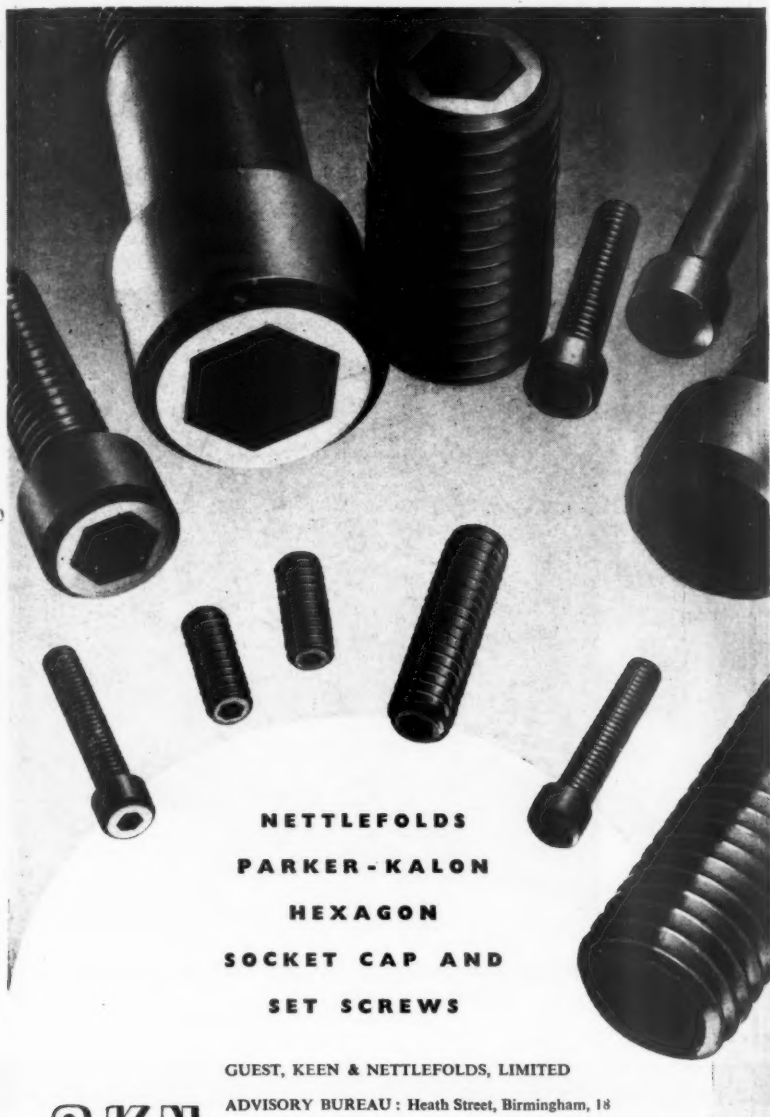
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Fitted to your existing lathes Turchan will show tremendous savings on work requiring multiple diameters, contours, tapers, centred and chucking work, external or internal.



**TURCHAN CAN BE FITTED TO ANY TYPE OF MACHINE TOOL**

*Full details on request*

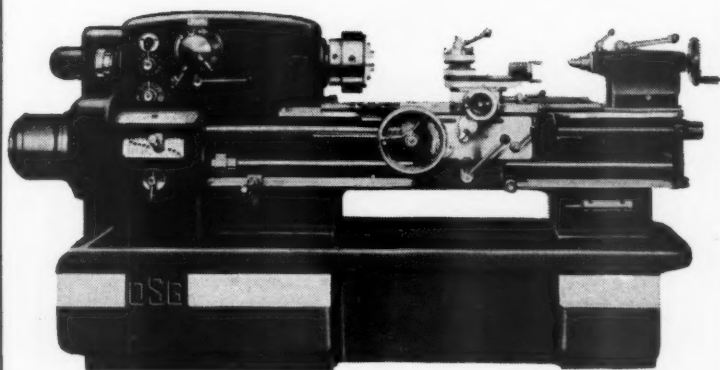
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13" SWING PRECISION LATHE.

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*13" to 30" Swing*

Flanged Vee Rope Motor Drive  
Self-Adjusting Clutch  
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## **CLEANING & DEGREASING MACHINES**



*Extract from "The Factory Manager"*

A bad bottleneck was cleared by the installation of Dawson washing plant for cleaning all components in process. Working a three-man team on day and night shift they found the paraffin spray-booth system inefficient, and unhealthy, there was, moreover, frequently a backlog of work piling up. The Dawson washers are expensive, but the savings they effect are remarkable. The night shift has been eliminated on this job: degreasing, hot rinsing and drying of a components manufactured on both shifts is now completed by day. The backlog was cleaned up by one machine on the first day of installation. Saving of time is conservatively estimated at 200 per cent on this 'mucky' but essential operation.

*Manufactured by*

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*Sole Distributors & Consultants*

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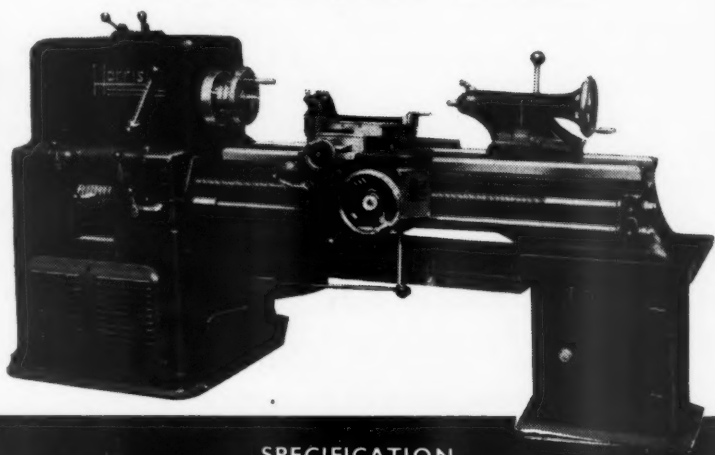
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## 7" CENTRE SLIDING, SURFACING AND SCREWCUTTING LATHE

A precision lathe of sturdy construction, specially designed for high production and easy maintenance. Pushbutton stations on apron and headstock minimise operational fatigue and provide immediate control. Ideal for toolroom or general purpose production.

*Available through leading Machine Tool Merchants.*



### SPECIFICATION

Swings over bed 14" • Swings in gap 24" • Distance between centres 3 feet to 6 feet • Spindle bore 2" Spindle speeds (12) 20-400 or 30-600 • Norton Gearbox feeds 32 • Motor 3 H.P. or 5 H.P.

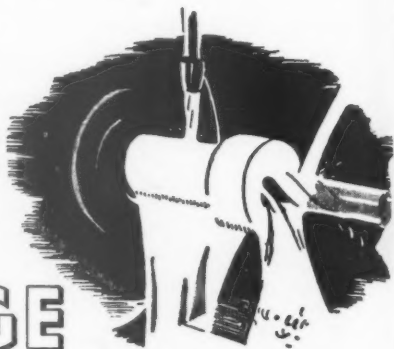
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COOLEEDGE yields a remarkable amount of rich, milky-white emulsion of marked stability when diluted because of its high fat content. Emulsions of 1 : 10 to 1 : 40 are an everyday range and mixtures of 1 : 60 upwards are not unusual in soft water areas. Obviously this ability to undergo a high degree of dilution without breakdown or rusting makes for final economy and when you remember that COOLEEDGE covers a wide range of tooling applications, it is easy to see

why COOLEEDGE is responsible for more tooling than any similar product made in this country. COOLEEDGE is fast cutting and protects tool life. It obtains a fine finish without fuss.

*Write for our Publication "Cutting Fluids."*



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ALSO INCLUDED IN THE WATER SOLUBLE RANGE ARE :—IRONEDGE · ALUMEDGE · FILEDGE  
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PRECIMAX fine boring machines can be supplied with spindles arranged and completely tooled to suit any component. It will pay you to investigate the possibilities of PRECIMAX fine boring on your own work.

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over a wide speed range

The VSG variable speed transmission gear is highly esteemed by leading engineers. The various advantages solve many transmission problems in a wide range of trades and industries. The chief advantages are:—

1. High torque at low speeds.
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3. Ability to "inch" and rotate at very low speeds.

Hand wheel, lever or screw controls can be fitted to suit individual requirements. Write for full particulars.

# 'VSG'

HYDRAULIC  
INFINITELY VARIABLE  
SPEED TRANSMISSION

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VSG D2

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We have been solving customers' problems for over thirty years . . . that is why Stellite is now used in every industry.

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*Literature available on request . . . tell us your problem*

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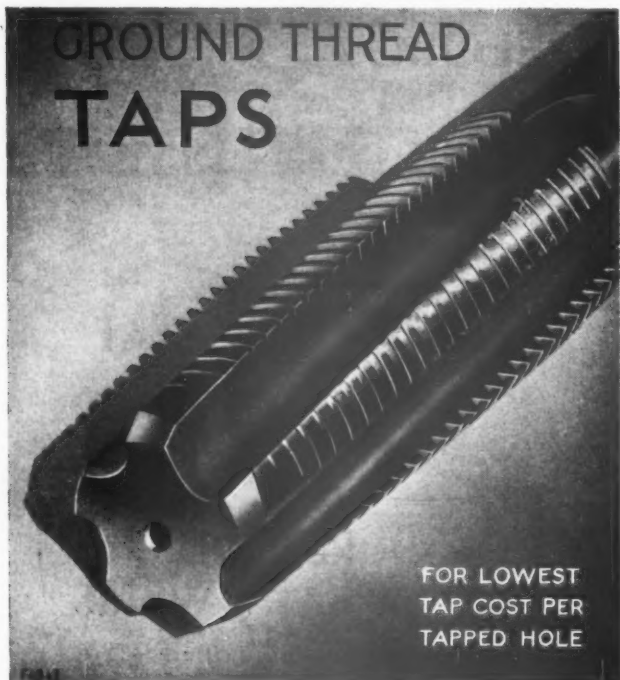
TIPPED TOOLS • TOOLBITS • TOOL

TIPS • MILLING CUTTER BLADES • HARDFACING ROD • W

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HERBERT



## GROUND THREAD TAPS

Made in our Exhall works from High-speed steel, to B.S.I. Grade 1 tolerances.

**STANDARD TAPS** are made in batches for stock and can be delivered promptly.

**SPECIAL TAPS** are designed to suit requirements.

*Please send enquiries to Threading Department.*

**ALFRED HERBERT LTD • COVENTRY**



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### A B.T.H. PRODUCT

Introduced in 1932, Ardoloy is unsurpassed for positive or negative-rake cutting.

**GRADES**—Five grades of Ardoloy have been developed to suit the requirements of various materials.

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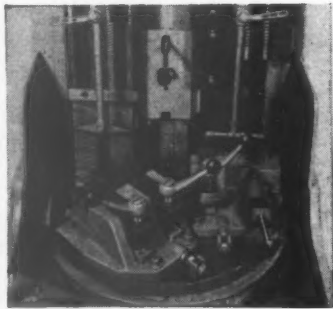
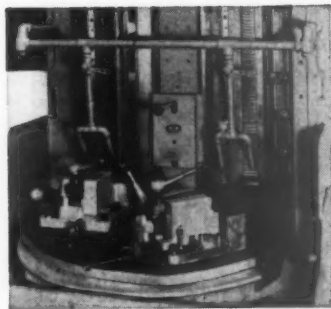
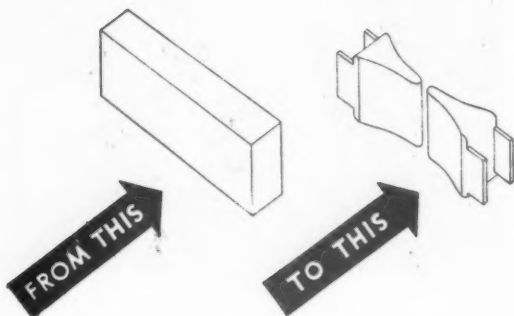
**DELIVERY**—A large and carefully selected stock of standard tools of the types and sizes in general use is carried. Standard tools should be used whenever possible to ensure prompt delivery.

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SOLE DISTRIBUTORS:

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The part illustrated above was made from a section of hot rolled bar stock  $\frac{1}{2}$ " x  $1\frac{1}{2}$ " x  $2\frac{1}{2}$ " by two Cincinnati Broaching Machines which transformed the bar stock into parts at the rate of 250 per hour.

Broaching operations, such as slotting, sawing and the finishing of flat, concave or convex surfaces are standard practice on many types of work but the above examples show the high productivity, economy and accuracy which can be achieved by combining one or more operations through the design of suitable broaching tools and fixtures.

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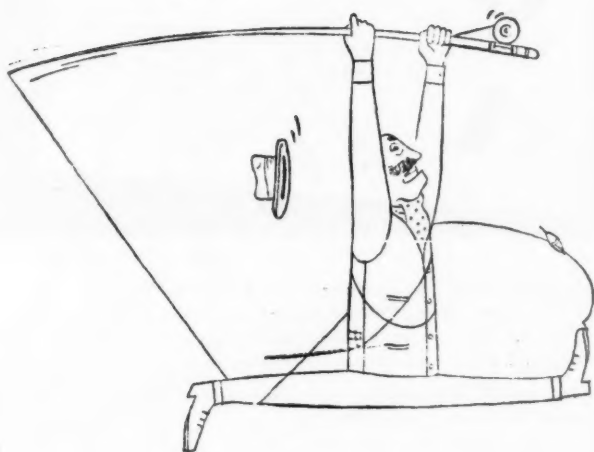
Sales Representatives for Great Britain and Northern Ireland: Charles Churchill & Company Ltd.,

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# Castability

## IMPERIAL SMELTING



**E**ase and speed of casting are accomplishments the fisherman aspires to and the MAZAK user achieves.

There is practically no limit to the complexity of shape which can be pressure die cast in MAZAK Alloy, carburettors and mortise lock parts being examples.

MAZAK's castability is combined with great strength. Because MAZAK is based on 'Crown Special' Zinc of 99.99 + % purity, inter-crystalline corrosion — causing distortion and disintegration — has been banished. Every batch of MAZAK is spectrographically examined.

Other advantages include high tensile and impact strength; ductility; durability; corrosion-resistance; low finishing cost and ease of plating. When such qualities are essential, use or specify MAZAK alloy, which provides the optimum combination.

# MAZAK

IMPERIAL SMELTING CORPORATION (SALES) LTD. 37 DOVER ST. LONDON W.1

# TO *Production Engineers*



Although I'm convinced that pneumatic equipment will improve my production rate, what about short runs, where the cost of special fixtures would not be justified?



The ENOTS PNEUMATIC VICE fills the bill. Loose jaws supplied can be machined to take the shape of the component and, by adjusting the jaw setting, you have a universal air-operated fixture, capable of exerting a pressure of up to 2 tons. A drill bush can also be attached to the fixed jaw, for drilling operations.

ENOTS PNEUMATIC VICE supplied as a complete unit with integral Control Valve and the pressure exerted at the jaws can be adjusted down from a maximum of 2 tons by means of an air-reducing valve.

Why not send for scale drawing and catalogue illustrating our full range of equipment?

Standard air cylinders are available from  $\frac{3}{4}$ " x 6" diameter bore and over 50 different types of control valves are included in our range.

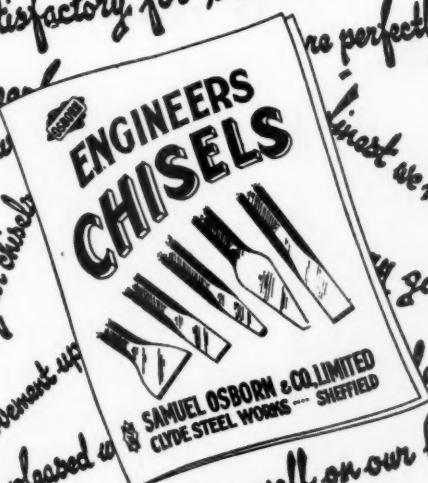


**AIRCLAMP  
PNEUMATIC  
EQUIPMENT**

Why not write for literature?

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"apparent that your chisels are the best."  
 "quite satisfactory for stainless welding."  
 "Excellent product."  
 "Successful as improvement up."  
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 "doing well on our hard castings."  
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 "stood up very well on Thermic welding."  
 "no perfectly satisfied."  
 "best we have ever had."  
 "good results."  
 "performance."



The quotations are extracts from the many letters of commendation received from customers all over the world

It will pay you to try a sample chisel. Send us the size and shape most suitable and we will send you one on sale or return.

A copy of our leaflet on Engineers Chisels sent free on application to:

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**CLYDE STEEL WORKS, SHEFFIELD**



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A compact and efficient unit  
embodying two-stage collec-  
tion and a 1/3 h.p. motor-  
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Send for details of this and  
larger units.



We extract the **DUST** from in**DUST**ry

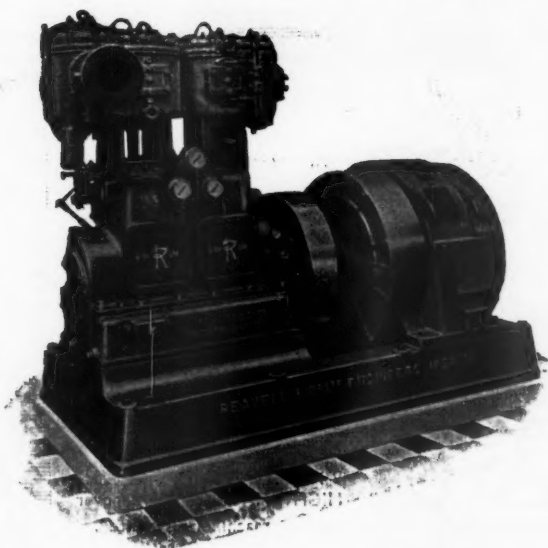
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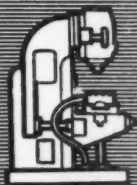
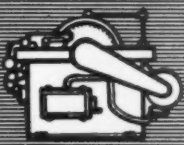
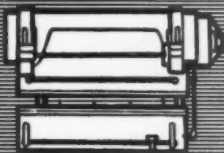
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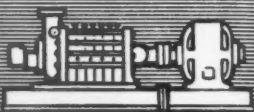

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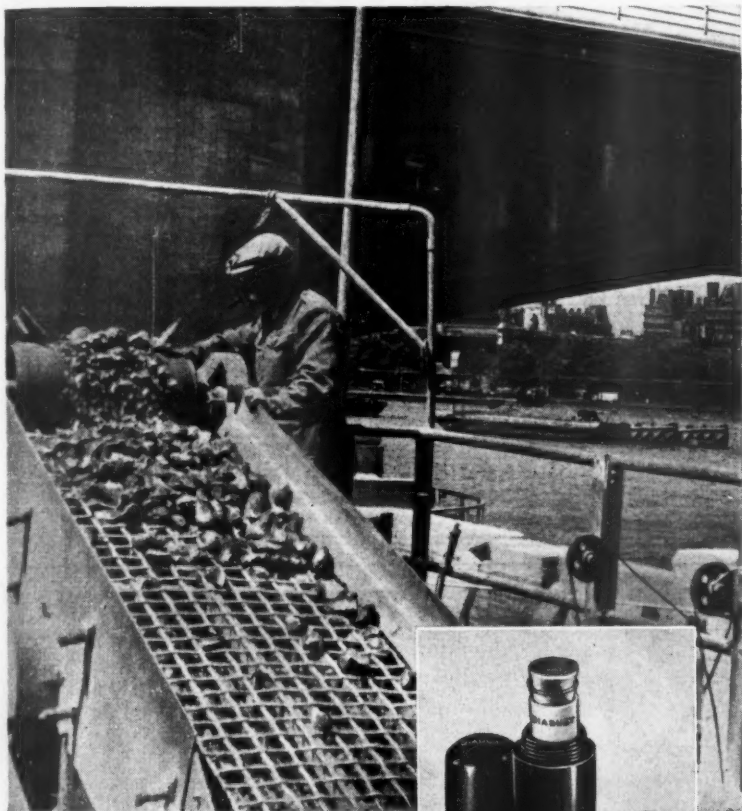



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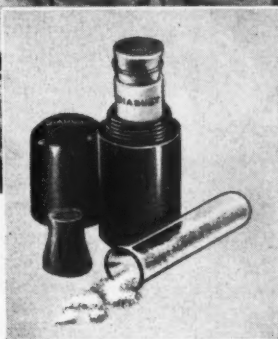
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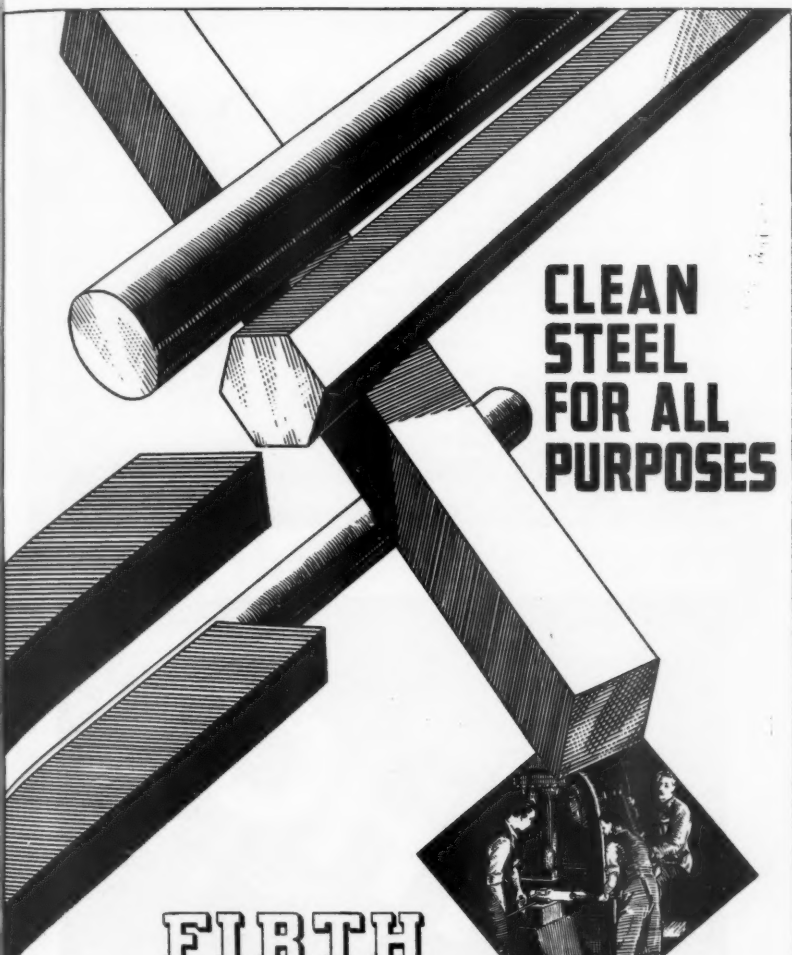
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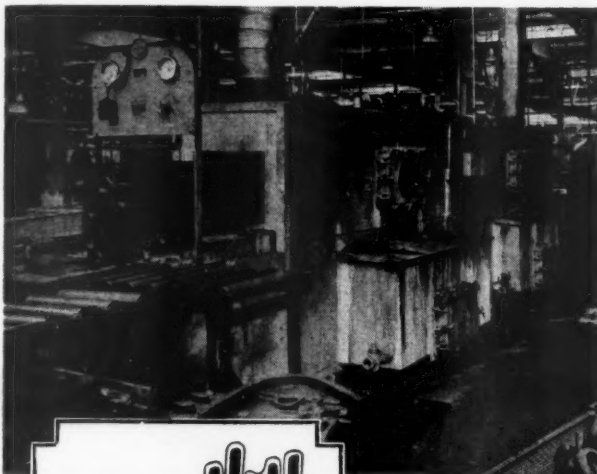
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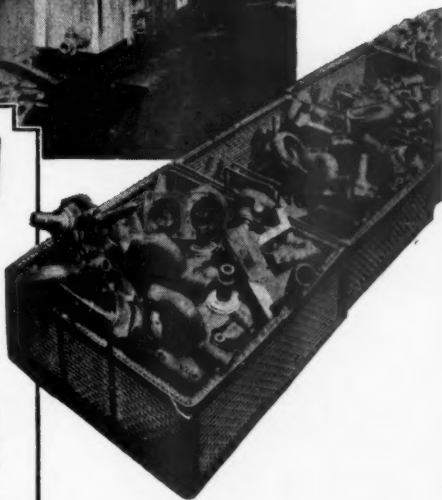


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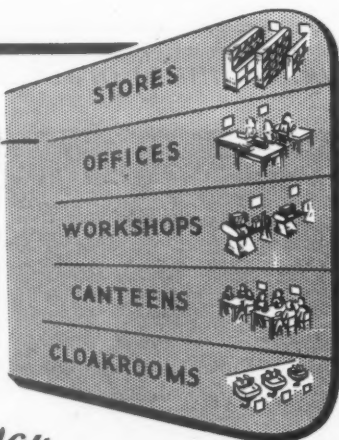


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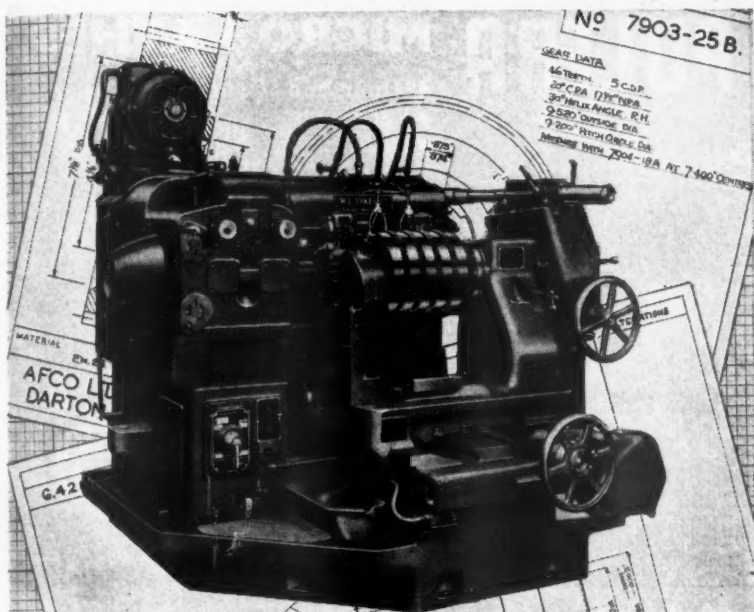
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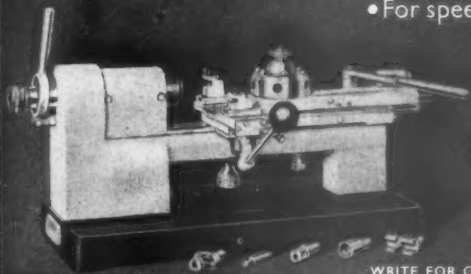


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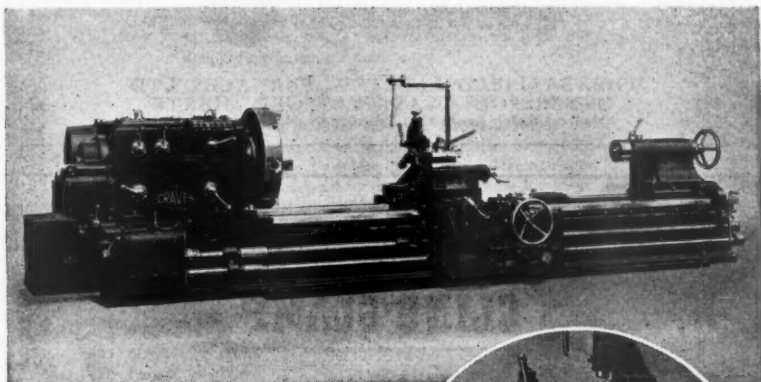
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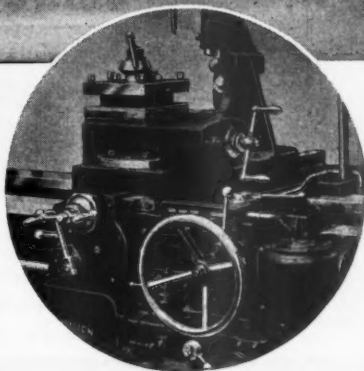
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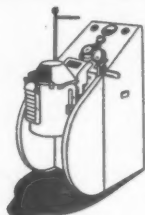


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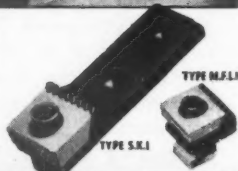
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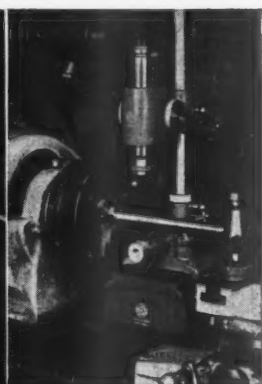
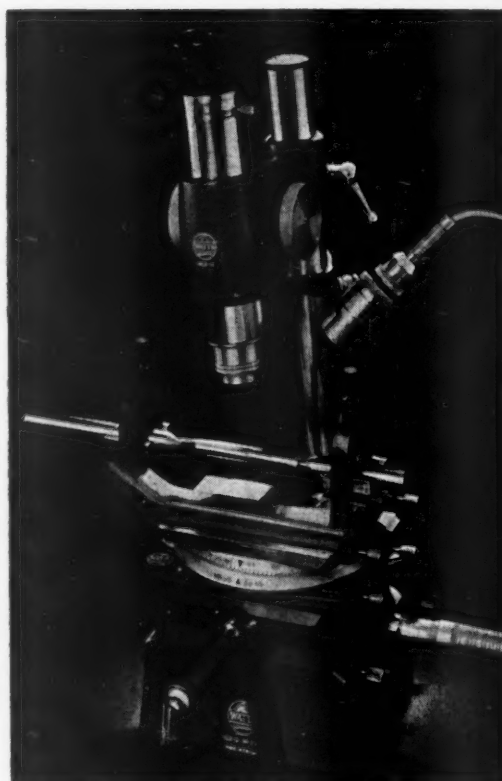
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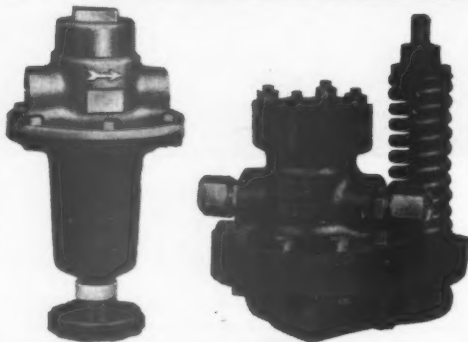
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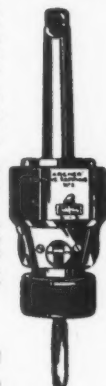
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